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CLOTTED CREAM.

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IN the counties of Devonshire and Cornwall the dairy industry is of paramount importance. A great amount of milk is produced and sold as such for consumption, but the chief interest attached to the industry lies in the fact that for generations these counties have been renowned for a particular variety of cream known as "Clotted Cream."

Historically, the industry is of more than passing interest, for there is good reason to believe that in some districts in Devonshire cream has been made for centuries. Twamley, famous as one of the earliest authentic writers on dairying in England, says, in a communication to the "Bath and West Society," dated 1791: "From the method used of heating the milk, is produced what is called 'clouted cream'; which I suppose should be termed 'clotted cream,' as the warmth causes the cheese particles to incorporate with the cream, makes it clot and become more mucid or slimy."

Very little information on clotted cream has been published, and no experimental work, designed to improve the standard methods of production, seems to have been carried out.

During the summer of 1912 the writer was deputed by the College with which at that time he was connected—The Midland Agricultural and Dairy College—to conduct an enquiry on the spot on behalf of the Board of Agriculture and Fisheries. The immediate reason for the investigation was as follows:

Information had been received that some farmers and dairymen made a point of adding a small quantity of water to the milk before setting the pans for the cream to rise, their contention being that by so doing the raising of the cream was facilitated and the milk was less likely to adhere to the bottom of the pan and become in some cases "burned."

Until comparatively modern times the milk which remains in the pan after the removal of the cream, and which is known as "scald milk," was used exclusively for the feeding of calves, and that being so the addition or non-addition of water to the original milk did not seem to be a matter of very grave importance. As the public demand for milk increased, however, the more enterprising dairymen saw that "scald milk," containing as it did such a valuable percentage of protein matter, as well as about 1 per cent. of butter fat, was a marketable commodity, and a considerable business was established in the selling of scald milk to certain sections of the population in Devonshire and Cornwall.

This new use for scald milk, which had formerly been regarded as an unimportant by-product, altered the position in respect of the addition of water to the original milk; for it meant that the public were purchasing milk to which extraneous water had been added and therefore milk which in the eye of the law was adulterated. It became, therefore, of importance to ascertain whether the addition of the water was essential for the production of the best quality cream.

In the course of the enquiry an attempt was made to investigate other points of interest to the industry, *e.g.*, the claim that typical "clotted cream" could only be made in the two counties. This was said to be due in some measure to the special nature of the local pastures, but principally to the breeds of cattle kept by the Devonshire and Cornish farmers. In the Exeter district, for instance, the herds chiefly in favour are Jerseys, North Devons and various crosses of these breeds; in the South of Devonshire, South Devons (South Hams) and crosses of these with Guernseys are more common; while in North Cornwall the herds consist principally of North Devons and various crosses.

As the College herd at Kingston was composed almost solely of high class Dairy Shorthorns, the opportunity seemed favourable for observing the influence of the breed of cattle on the quality of typical "clotted cream." The opportunity was also taken to collect information regarding the chemical composition of "clotted cream" and "scald milk."

Throughout the experiments, the original milk, the clotted cream, and the resulting scald milk were weighed and analysed. As the milk was usually set to cream in the evening, a rich milk was secured, closely approaching in quality that used by the Devonshire and Cornish makers.

Before commencing the experimental work, suitable utensils had to be obtained, and a form of apparatus embodying the chief features of the best types in use by makers of clotted cream in the West Country was designed and fitted up in the dairies at the College.*

Briefly, the apparatus consists of a shallow galvanised iron tank, raised on strong iron supports, the cover being of block tin with two holes to receive the pans of milk. The pans are made of block tin, 20–24 in. in diameter at the top, 12–14 in. in diameter at the bottom, and 8 in. deep. Water is contained in the tank, and the heating effected by means of steam passing through pipes direct into the water, the conducting pipes being arranged in such a manner as to avoid undue vibration. Arrangements were made for two pans to be scalded simultaneously under identical conditions, one pan containing milk alone, and the other containing milk with the addition of varying quantities of water. In each test two pans were subjected to the scalding process, one of which was always "normal" and acted as a "control" upon the other. While occasionally a smaller quantity of milk was set for creaming, the usual amount was six quarts in each pan.

The milk to be used was thoroughly mixed and divided by weight into two equal parts. Into one pan a certain amount of water was poured, and then one half of the milk, while the remaining half of the milk was poured into the control pan.

After an interval of from 12 to 15 hours to allow the cream to rise, the scalding process was carried out. It proved to be desirable that, before the pans were put on, the temperature of the water in the tank should be nearly at boiling point. After a few preliminary trials this temperature was fixed at 195° F. to 200° F., but during the latter half of the experiments an alteration was made, the water being raised to a temperature of 205° F.

The experimental work showed that, other conditions being equal, the most satisfactory results were obtained when a thermometer was used to ensure the adoption of a uniform temperature. This agrees with the experience of the

* It has not been possible to obtain a photograph of the actual scalding appliance as used in the experiments. The apparatus was, however, a combination of the appliances shown in Figs. 3 and 5.

best makers in the West Country, and it is probable that a more general adoption of standard uniform temperatures would result in the production of a better article. It is possible, however, that one standard scalding temperature would not give uniform results in different districts under widely varying conditions.

At the beginning of the experimental work the scalding was allowed to take from 15 to 20 minutes, and the temperature of the milk and cream, when removed from the heating apparatus, varied from 180° F. to 185° F.

After the first four trials a change was made by scalding from 25 to 30 minutes. This length of time was continued throughout and the change was completely justified by the results. During the second half of the experiments the temperature of the cream and milk at the conclusion of the scalding was 187° F., and it was then that the finest samples of cream were secured.

After the scalding was completed, the pans were taken off and allowed to remain for 24 hours, when the clotted cream was skimmed (Figs. 1 and 2). This operation called for great care in order that both the "control" and the experimental

TABLE I.

Analyses.

Date, 1912.	No.	Milk. Fat.	Milk. Total Solids.	Milk. Weight of Milk.	Milk. Amount of Water added.	Scald Milk. Fat.	Scald Milk. Total Solids.	Cream. Fat.
		per cent.	per cent.	lb.		per cent.	per cent.	per cent.
July 20 ..	1	4·1	13·18	30	None	0·8	10·25	59·69
„ 21 ..	2	—	—	22	None	1·0	10·41	58·97
„ 22 ..	3	4·5	13·03	20	None	0·8	10·12	56·76
„ 23 ..	4*a*	3·9	12·68	10	None	0·45	10·00	62·65
	4*b*	—	—	10	1 gill	0·45	9·73	61·82
„ 25 ..	5*a*	3·35	12·61	15	None	0·6	10·11	62·61
	5*b*	—	—	15	1 pint ..	0·6	9·29	62·79
„ 25 ..	6*a*	3·7	12·81	15	None	0·75	10·25	64·90
	6*b*	—	—	15	1 quart ..	0·7	8·97	62·83
„ 26 ..	7*a*	—	—	15	None	0·75	10·19	66·27
	7*b*	—	—	15	2 quarts ..	0·60	7·84	68·34
„ 28 ..	8*a*	4·8	13·43	12	None	1·0	10·13	62·51
	8*b*	—	—	12	1 gill	0·9	9·83	64·79
	8*c*	—	—	12	2 gills ..	0·85	9·57	64·40
	8*d*	—	—	12	3 gills ..	0·85	9·41	64·45
„ 30 ..	9*a*	4·7	13·56	15	2 gills ..	0·7	9·97	64·04
	9*b*	—	—	15	None	0·7	10·41	63·47
	9*c*	—	—	12	2 gills ..	0·5	9·75	63·88
	9*d*	—	—	12	None	0·65	10·32	66·59
Aug. 1 ..	10*a*	0·1	9·06	15	None	0·5	10·00	62·59
	10*b*	0·05	9·23	15	None	0·4	9·68	64·23
„ 1 ..	11*a*	4·3	13·24	15	None	0·9	10·21	64·10
	11*b*	—	—	15	2 gills ..	0·9	9·83	64·42
„ 2 ..	12*a*	4·55	—	15	None	0·9	10·16	62·67
	12*b*	—	—	15	1 pint ..	0·8	9·35	62·92
„ 3 ..	13*a*	4·7	13·53	15	None	1·05	10·25	64·72
	13*b*	—	—	15	1 quart ..	0·95	8·90	65·37
„ 4 ..	14*a*	4·25	12·89	15	None	0·6	10·02	64·56
	14*b*	—	—	15	1 quart ..	0·65	8·64	64·76
„ 5 ..	15*a*	4·5	13·07	10	None	0·7	9·97	59·47
	15*b*	—	—	10	2 gills ..	0·8	9·48	58·05
„ 6 ..	16*a*	4·8	13·84	10	None	0·95	10·59	60·33
	16*b*	—	—	10	1 gill	0·85	10·18	61·17

Fig. 1.—Skimming the Cream in a West-Country Dairy.

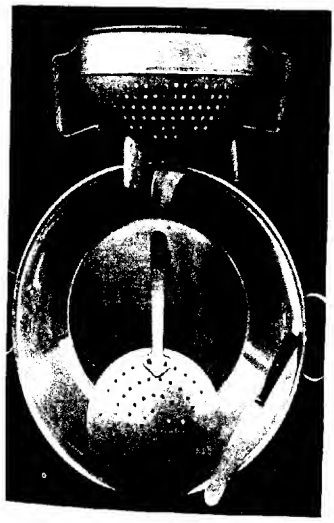

Fig. 2. Some of the Utensils used in the Process :—Three-legged Cream Drainer; Pan in which Milk is set and scalded; Skimmer; Palette Knife.

Fig. 3. Steam Scalding Apparatus with 2 Pans of Milk in position. The Cooling Room may be seen in the background.

pans should be skimmed under the same conditions. Any excessive mixing and stirring of the cream for sampling was liable to destroy the texture, and there was the danger of converting it into butter. In addition to the samples for analysis, samples were also taken for the purpose of judging the flavour, texture, and general marketable quality of the cream. The results of the analyses are shown in Table I.

One of the advantages claimed by those who favour the use of water in the milk is that the sediment, consisting of white specks found in the bottom of the pans when the scald milk is poured away, is considerably less in the pans containing some amount of water than it is in those containing normal milk. The College experiments proved, however, that water on the bottom of the pan has no influence on the proportion of sediment remaining after the scald milk is removed. In fact, on some occasions there was actually more sediment from the watered milk than from the normal milk.

There was no appreciable difference between the weight of cream skimmed from the normal milk and the weight of cream from the watered milk.

The average weight, taking both the experimental and "control" pans, worked out at 10·39 oz. cream from 15 lb. of milk, which shows that 1 lb. of clotted cream is produced from 23 lb. of milk. The Devonshire makers consider that 1 lb. of clotted cream is obtained from 20·5 lb. of milk, but no experimental data are available to bear out that opinion, and, having regard to the difference in breeds of cattle, the yield of cream obtained in the College experiments does not appear to compare unfavourably with the accepted figures of the West Country makers.

Some makers have contended that the addition of water assists in the production of a cream having the most typical and desired flavour, and, as from the commercial aspect this is obviously a matter of great importance, the samples of cream when skimmed were judged for flavour at the College by Mr. Alec Todd, Head of the Dairy Department, and by the writer. It was found invariably that the cream obtained from watered milk was inclined to be insipid and lacking in flavour as compared with the normal cream. The importance of this phase of the enquiry appeared so great that, as soon as a uniform method could be arrived at, arrangements for judging were made with two Devonshire producers, both of them engaged commercially in the business, and one of them being a well-known exhibitor of cream and holder of many of the highest

awards. The samples were posted to them as early as practicable, and would usually arrive some 24 to 36 hours after skimming. For this purpose the creams were simply labelled A and B, respectively, and no particulars were given to the judges as to the character of the samples.

Abstracts from the reports of these gentlemen are as follows, and further particulars as to the respective samples may be gathered from the tables :—

9*d* (no water) ..	"Best specimen yet seen, and 9*c* a close second. Granulation all right, but each lacks the characteristic flavour."
10*a* ,, .. / 10*b* ,, .. \	"Samples 10*a* and 10*b* are the thing."
11*a* ,, ..	"To me a very good cream, the flavour and texture as much like our cream as you will get. I think if you produce cream like that you will have a very saleable article."
11*b* (2 gills water)	"Arrived 48 hours after skimming, and both quite sweet. Did not like this sample. Seemed like separated cream scalded, being too pasty. Not much flavour, in fact did not care for it at all."
12*a* (no water).. / 12*b* (1 pt. water) \	"Both typical—2½ days old. Sample 12*a* very nice and sweet, and sample 12*b* developing bitterness."
12*a* (no water).. / 12*b* (1 pt. water) \	"Consider them both good, but prefer 12*a* on account of flavour."
13*a* (no water).. / 13*b* (1 qt. water) \	"Both typical with no striking difference—after 36 hours sample 13*a* still very nice and sweet, while sample 13*b* has a slight suggestion of bitterness."
13*a* (no water).. / 13*b* (1 qt. water) \	"Think them both good—very little difference in them, 13*a* possibly being a little better in flavour."
14*a* (no water).. / 14*b* (1 qt. water) \	"Both are all right and quite typical, but I think sample 14*a* has the better flavour."
14*a* (no water).. / 14*b* (1 qt. water) \	"Both good. Sample 14*a* good in flavour and texture very good. Sample 14*b* not so good in texture, being a little pasty, and not quite so good flavour as 14*a*."

The samples submitted represented cream produced from milk containing quantities of water varying from 2 gills to 1 quart per lot of milk, and in each case the cream from the corresponding "control." It will be noticed that opinion was invariably in favour of the sample of cream produced from milk to which no water had been added.

As regards the qualities required in a typical sample of clotted cream, it must be granular in texture; it should be firmer than the thickest of cream obtained from a separator, but not so firm as a freshly-made cream cheese; the colour

should be golden, not unlike the colour of the butter made from pure bred Guernsey cows. The cream must not be too wet or "mushy," for, if so, it ceases to be characteristic; moreover if too much moisture is present it indicates an excess of scald milk incorporated in the cream, and the keeping qualities are thereby considerably impaired. The cream must have a "nutty" taste, and a decided scalded flavour pleasing to the palate.

A reference to Table I. indicates that the percentage of butter-fat in the original milk cannot have any considerable influence upon the percentage of butter-fat in the finished cream owing to the method of skimming which at present prevails; but it may be inferred that, other conditions being equal, the richest and finest cream is likely to be obtained from the richest milk.

Table II. gives the percentage of "Butter-fat," "Total Solids," and (by deduction) the percentage of "Solids not Fat" in the scald milk obtained from the normal milk.

TABLE II.

Scald Milk.

Samples (without water).	Butter-Fat.	Solids not Fat.	Total Solids.
	Per cent.	Per cent.	Per cent.
1	0·80	9·45	10·25
2	1·00	9·41	10·41
3	0·80	9·32	10·12
4*a*	0·45	9·55	10·00
5*a*	0·60	9·51	10·11
6*a*	0·75	9·50	10·25
7*a*	0·75	9·44	10·19
8*a*	1·00	9·13	10·13
9*b*	0·70	9·71	10·41
9*d*	0·65	9·67	10·32
10*a*	0·50	9·50	10·00
10*b*	0·40	9·28	9·68
11*a*	0·90	9·31	10·21
12*a*	0·90	9·26	10·16
13*a*	1·05	9·20	10·25
14*a*	0·60	9·42	10·02
15*a*	0·70	9·27	9·97
16*a*	0·96	9·64	10·59

Table III. shows the complete analyses of the samples of cream raised and taken from the normal milk; it will be seen that the percentage of butter-fat in clotted cream may be as high as 66·59 per cent., the more usual percentage being, however, in the region of 62–64 per cent.

TABLE III.

Clotted Cream.

Samples (without water).	Water.	Butter-Fat.	Solids not Fat.	Total Solids.	Protein.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1	35·46	59·69	4·85	64·54	3·07
2	33·05	58·97	7·98	66·95	3·00
3	37·29	56·76	5·95	62·71	3·45
4*a*	32·87	62·65	4·48	67·13	3·51
5*a*	31·03	62·61	6·36	68·97	3·58
6*a*	28·10	64·90	7·00	71·90	3·64
7*a*	27·94	66·27	5·79	72·06	3·19
8*a*	29·68	62·54	7·78	70·32	2·94
9*b*	28·15	63·47	8·38	71·85	2·62
9*d*	27·57	66·59	5·84	72·43	3·58
10*a*	30·18	62.59	7·23	69·82	3·26
10*b*	29·06	64·23	6·71	70·94	3·19
11*a*	30·40	64·10	5·50	69·60	3·26
12*a*	31·46	62·67	5·87	68·54	3·64
13*a*	27·87	64·72	7·41	72·13	3·45
14*a*	29·90	64·56	5·54	70·10	3·39
15*a*	33·28	59·47	7·25	66·72	3·77
16*a*	31·74	60·33	7·93	68·26	4·09

During the course of the investigation a number of bacteriological problems suggested themselves, and of these the most important appears to be the explanation of the derivation of that unique flavour so characteristic of the best samples of clotted cream. While the actual scalding process is to a great extent responsible for the specific flavour, there is every reason to believe that, even before the scalding takes place, the flavour has in a great degree been decided.

During the time which elapses between the setting of the milk for creaming and the scalding, bacterial action is taking place, and the various organisms present are exerting an influence upon the flavour of the milk itself. When the scalding begins, the currents which are set up in the milk and cream tend to distribute the bacteria evenly throughout the whole, and the flavours which are the result of volatilisation are taken up and retained in the cream.

The scalding process is essentially a system of pasteurisation, the efficiency of which depends largely upon the types of the bacteria which comprise the original flora of the milk.

Such organisms as are able to resist the temperature employed in the heating will be free to multiply in the period of twenty-four hours during which the milk and cream are left to cool; and, as they will be present in the cream as well as in the

FIG. 4.—Cooling Room of a large Dairy.

FIG. 5.—Cooling Room of Dairy referred to in Fig. 6.

scald milk, the flavouring of the cream may vary according to the types and number of the bacteria which have survived the heating.

Some support is lent to this by a consideration of the report on certain of the samples of cream produced during the investigation at the Midland College. It will be noticed that in each case the flavour of the sample which had been taken from the cream raised on normal milk was considered the better, *e.g.*, in samples 12*b* and 13*b* there was a distinct bitterness, while in samples 12*a* and 13*a* no such taint was discernible.

Having taken these samples at the same time, and knowing that the milks, normal and watered, had been subjected to identical conditions in every respect, the writer was led to infer that some organisms present in the water had survived the scalding process and were, in some measure at any rate, responsible for the flavouring detected. The scope of the work at the time did not, however, allow of bacteriological examinations being made either of the water, the milk or the cream.

The investigation also indicated that the keeping properties of clotted cream are greater than is sometimes supposed. Many who are engaged commercially in the industry express the opinion that cream should be consumed within about 24 hours after skimming, but it will be seen that some of the samples submitted were quite good and typical for periods of 36, 48, and 60 hours after skimming.

The question of the keeping qualities of clotted cream is second only in importance to flavour, and it should be possible by a further investigation to obtain some useful information on this point.

The results of the experiments conducted thus far tend to show that :—

1. From normal milk clotted cream can be produced superior in flavour and texture to that produced from milk to which a quantity of water has been added.

2. The addition of water does not appreciably add to the actual weight of cream produced and does not appear to affect the percentage of fat in the cream.

3. The use of water in the bottom of the creaming pan has no influence whatever on the amount, or, as far as can be seen, the nature of the sediment which remains in the pan after the removal of the scald milk.

4. The clotted cream produced from milk to which water has been added does not possess the keeping qualities of similar cream raised from normal milk.

5. As regards the effect upon the by-product, the position appears to be that, while depreciating both the food and the commercial value of scald milk, no corresponding advantage can be shown to result from the use of water either as concerns the scald milk or the clotted cream. In fact, the experiments tend to prove that there are sufficient disadvantages to warrant a discontinuance of the practice.

6. Provided a suitable system be adopted and reasonable care be taken in management and manipulation, clotted cream, having the typical and characteristic properties, can be produced in any district.

7. While a rich milk is preferable, it is not at all essential for the production of characteristic clotted cream that only the breeds favoured by the agriculturists of the "West Country" should be employed.

8. The flavour and the keeping properties of clotted cream are problems of a bacteriological nature.

Methods in Vogue in Devonshire and Cornwall.

It may be of interest in concluding this article to give some account of the methods adopted in making clotted cream in its native counties. As a first example, a modern dairy in the neighbourhood of Exeter may be mentioned. Here it may be noted that the milk is poured into the pans, and, after standing for some 10–12 hours, is scalded. For this purpose the dairies are fitted with long copper troughs to accommodate the water, with steam connections for the heating (Fig. 3). Covers made of copper fit on the top, and these are hollowed in such a way as will admit of the pans being supported and at the same time surrounded by the water. The steam is turned on and when the water has been brought to the boiling point the pans are put on. The temperature of the milk and cream is not usually allowed to go higher than 190° F., and the operation is completed on the average in about 15 minutes.

A thermometer is used, but experienced dairymen often tap lightly the rim of the pan and if small bubbles rise on the surface of the cream, consider that the scalding is completed. The pans used are large enough to deal easily with two gallons of milk.

From the scalding-room the pans are taken to a cooling room (Fig. 4), and about 24 hours later the cream is taken off and lifted into a metal strainer by means of specially adapted skimmers. These skimmers have long handles and small perforations. The bottom and sides of the metal strainer

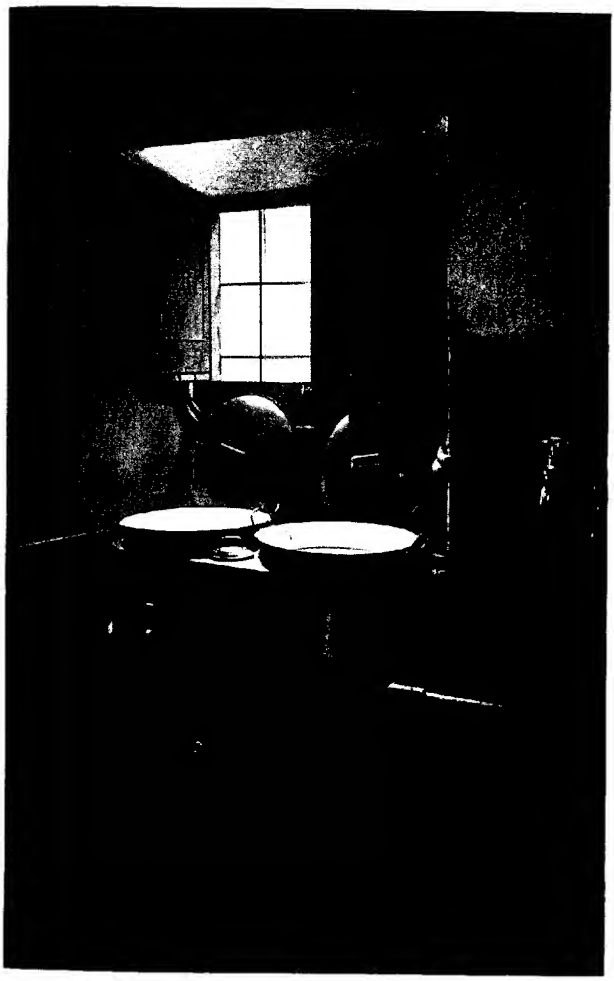

FIG. 6.—"Furnace and 'Copper.'" Scalding Apparatus as used in a well known Newton Abbot Dairy.

are perforated in order to permit of the thinner cream passing away, leaving only the typical thick cream in the vessel. The cream which passes through the perforations is utilised for butter-making.

The cream having been skimmed is ready for sale at once, and for the purpose of transit is packed into small earthenware jars or in tins. A type of vessel which is now coming into vogue for use as a receptacle for cream is the wood pulp cup.

Some idea as to the possibilities of the clotted cream industry may be gathered from the fact that, in one large dairy in this part of Devonshire, no less than one ton of cream is made and distributed each day during the season.

A well-known maker in the vicinity of Newton Abbot uses a "copper" the water in which is heated underneath by a furnace (Fig. 6). His pans are of enamelled metal (Fig. 5) and the scalding process is conducted for from 30–45 minutes. The temperature of the water in the copper at the conclusion of the process is about 212° F.

In Plymouth, one large dairy deals with the milk of 250 cows; the pans for scalding are placed on steam-heated water, which is at the boiling temperature before operations are commenced, and then the heating is continued for from 15 to 17 minutes. Two other dairies of considerable size adopt a similar treatment, the heating being continued 15 minutes and 25 minutes respectively.

In North Cornwall there are to be seen one or two examples of the old-fashioned dairies, and in these cases, it was often stated that the addition of water prevented "catching." It was on the moors not far distant from Camelford that an opportunity presented itself of seeing the production of clotted cream under conditions in which the heating was done by means of peat fuel, cut from the moors on the homestead. This was the only instance in the whole of the enquiry where the writer succeeded in finding this method of heating.

The farm in question was a lonely homestead on a wide expanse of Cornish moor. The atmosphere of the room in which the dairy operations were carried on was redolent with the smell of peat. The fireplace was old and contained no range of any description, the fuel consisting solely of peat. This is allowed to burn and smoulder until little remains except the red and glowing embers. These are put into an iron pot supported on a tripod, and on the pot is placed the small crock of milk. The supply of smouldering peat is kept constant and in from 1½ to 2 hours the "scalding" is completed.

The cream raised in this manner is unique and has a flavour of its own bearing a resemblance to the odour of smouldering peat. Even to-day there are often connoisseurs of "clotted cream" who are not satisfied with any other than cream heated over a fire of peat.

The author wishes to acknowledge his indebtedness to Dr. Wm. Goodwin, Principal of the Midland Agricultural and Dairy College, for his advice and warm interest; to Mr. Alfred Appleyard, M.Sc., now of the Rothamsted Experimental Station, who conducted the whole of the analyses upon which the tables are based; to Mr. A. O. Rowden, of Exeter, and Mr. J. Dolbear, of Newton Abbot, for their services during the later investigation; and to the producers of clotted cream in Devon and Cornwall for their courtesy and assistance during the preliminary enquiry.

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SOIL ANALYSIS.

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ANALYSIS is the method adopted by the expert adviser for obtaining certain information about a soil. It includes chemical, physical and bacteriological investigations, and it may be accompanied by more general field observations for the purpose of discovering the nature of the subsoil, of the water supply, and of the climatic and other conditions important for the growth of plants.

A full investigation of this kind is found to be too laborious for ordinary use, and in practice shorter methods are commonly necessary. These do not aim at giving a complete account of the soil, but they express the amounts of certain substances present which are known to have an important effect on crop production. Experience has shown, however, that these methods are at their best when used for purposes of comparison, and as far as possible they should only be applied in this way. The analysis of a casual sample of soil from a district of which

the analyst has no intimate knowledge is a much more difficult affair, and is often unsatisfactory both to him and to the farmer. Indeed, from the farmer's point of view, the question as to whether a soil analysis is worth conducting depends very largely on the possibility of making a comparison with some similar soil about which definite knowledge has been obtained by field experiments.

Fortunately, this country is now provided with organised schemes under which such systematic field experiments may be made and the results recorded; the possibility of setting up comparisons is therefore steadily increasing.

How a Soil Analysis may be Useful.

In at least three distinct cases useful help can be given by the soil expert.

(1) The simplest case arises when a farmer wants to know whether he has any reasonable chance of obtaining results similar to those demonstrated by field experiments on another farm in his locality. Where, for instance, such experiments have demonstrated the advantage of applying lime, phosphates, or potash, the expert can with considerable accuracy say whether similar results can be obtained on the farm in question. He cannot be absolutely certain, as there is always an unknown factor, but the chances are that he comes out right. There is no doubt that much more use might be made of field experiments in this way with considerable gain both to farmers and the officers advising them.

(2) Another comparatively simple case arises when a farmer wishes to adopt some system of cropping or soil treatment known to give good results elsewhere in the locality, but before embarking on the change he desires to know how far his soil conditions resemble those where the method works well. Here examination may reveal some difference which, while not very obvious to casual inspection, is of vital importance to the success of the enterprise. Two heavy soils, for instance, may look very much alike, but one may owe its heaviness to very fine particles and the other to silt particles. Methods that succeed in one case have often failed in the other. If the farmer is aware of the difference he can make his plans accordingly.

(3) The problem is rather more extensive when a man is entering on a new farm and wants to obtain as complete information as possible about the soil. Here the farmer must remember that no one person can possibly give him all the

information that could be gleaned; chemists, bacteriologists, physicists, could each say a good deal without exhausting the subject. A selection has to be made, and much time is saved where an interview can be arranged on the spot with the expert consulted, who can then ascertain exactly what information is wanted. Most farmers feel that they have a bent for some special branch of production, and they naturally wish to exercise their powers in the right direction.

On the other hand, many soils have some special feature fitting them for some particular crops better than for others. A certain amount of accommodation is possible on both sides: The farmer may alter both his scheme and his soil, and the best results cannot be obtained till the process is complete and the scheme made to fit the possibilities of the soil. This end may be and often is attained by the costly and bitter method of experience; it can, however, often be reached more quickly by securing the services of the expert. In the first place an investigation will show whether the soil and the general conditions resemble those obtaining where the proposed system of husbandry is known to be a success. It may reveal the more important differences and enable the farmer and the expert to discuss methods by which they may be overcome. Secondly, a comparison of the results with others obtained in the locality will show the expert to what type the soil belongs, and he can then inform the farmer what systems of farming are known to succeed on this type. Thus the materials for a comparison can be got together. Although no one would pretend that anything like complete information could be obtained in this way it is certain that money and valuable time can often be saved.

Difficulties.

The problem becomes much more difficult directly the soil expert gets away from comparisons and is asked to make an absolute pronouncement on a sample of soil considered by itself. Of course, if he has considerable local knowledge, or if a soil survey of the district has been made, he may discover a standard of comparison and then matters proceed tolerably smoothly. Failing this, he feels that his ground is very uncertain; he has to try and put some absolute value on the quantities obtained by analysis, and in interpreting the results a good deal of balancing of probabilities becomes necessary; this is always a delicate business and is likely enough to miscarry.

Still more difficult is the case when the farmer does not ask for definite information on specific points, but puts the general (and natural) question—How can I manure my land at greater profit than I am getting at present? Although every farmer must ask himself this question he will, after careful thought, quickly realise that it is much too complex to be answered off-hand. The analyst may be able to report that similar soils under similar conditions have given satisfactory returns for the application of certain manures to certain crops; but the question whether equal returns would be satisfactory on the farm in question depends on many other factors—the amount of capital available, the market facilities, the general economy of the whole farm, &c.—and a satisfactory answer can usually only be obtained when the whole question has been discussed by the farmer, the agricultural expert and the soil expert. Short of this the best method is for the analyst to suggest two or three systems of manuring, and for the farmer to give them as good a trial as possible before making the final selection. This problem, of course, becomes more and more easy as the number of analyses is multiplied, but it continues to be very difficult until the expert's work is well organised.

Conclusions.

The farmer who wishes to derive the maximum assistance from soil analysis must bear the following points in mind:—

1.—The simplest problem for the expert is to compare soils, and, therefore, the chances of success are greatest when a soil survey has been made or when some similar soil has been under proper field experiments.

2.—The object of the analysis is to furnish information, but no one has the time, even if he had the power, to set out all that can be discovered about a particular sample of soil. The farmer must, therefore, arrange to go over the land with the expert and discuss on the spot the various points on which information is desired; the necessary samples can then be drawn with the proper tools and with all due precautions.

3.—Finally, it should be remembered that the problem is very difficult indeed when no satisfactory standards exist, and where the expert has not made a personal inspection; so much balancing of probabilities has to be done that no expert can give more than a general opinion or do more than submit two or three alternative schemes for consideration and trial.

THE FEEDING OF LINSEED TO CALVES.

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LINSEED in one form or another is in general use for calf feeding on farms where it is the practice to sell the bulk of the milk, or where the milk is largely used for cheese-making, or where butter is made and only skim milk or separated milk is available. Crushed linseed may suitably be added to skim or separated milk for calf feeding, but linseed cake meal (*i.e.*, ground linseed cake) would usually contain insufficient oil for the purpose, especially for feeding with separated milk. When little or no skim milk is available, calf meal containing only a moderate proportion of linseed should be used; crushed linseed alone would be too oily, and linseed cake meal alone too rich in albuminoids.

Linseed is a very good and very safe food when properly used, but its preparation requires some care, since a poison—prussic acid—may be formed if the conditions are such as to bring together two substances present in the seed, viz., an enzyme and a substance known as *Linimarin*.

1. In the first place different kinds of linseed vary according to their origin in respect of the amount of poison which is capable of being produced from them. As a rule linseeds grown in England are less poisonous than those grown in hotter climates.

2. In the second place, with linseed cake, the amount of prussic acid which may be formed will vary with the treatment of the seeds previous to the expression of the oil. If the seeds are only subjected to a gentle dry heat, the removal of the oil has the effect that the poison (together with the other remaining constituents of the seeds) is greater proportionately in the cake than in the seeds. If the seeds are subjected to both steam and heat, the enzyme is either destroyed or at least decreased in amount, and the rate at which the poison will be formed is diminished.

It happens that, while containing more poison, linseed grown in hot climates contains less water than English-grown linseed, and this renders it necesssary for the manufacturer to use steam before pressing the seeds, thus unconsciously counteracting the higher proportion of poison. The extent to which this counteraction takes place varies, however, so that corresponding variations occur in the cakes produced. In some

cases only a very small proportion of the total amount of the poison is liberated. There is, however, no linseed meal which contains so much Linimarin that it could not be rendered quite harmless if fed in a proper manner.

3. In the third place, it may be assumed for all practical purposes that there is extremely little risk of adult animals in good health being poisoned, as both their saliva and gastric juice check the development of the poison in the body.

The problem of the prevention of poisoning is thus resolved into the question of the proper preparation of linseed when feeding to young or sick animals.

In this connection it may be definitely stated that so long as the seed is fed whole, or even if it be fed simply crushed, there is no risk of poison forming; but if the seed be both crushed and soaked in water the conditions favour the production of the prussic acid, especially if the linseed is subjected to a dry heat before soaking, in which case the maximum formation of poison takes place. Further, if the linseed in the form of fine meal is partly mixed with warm water so that the meal is in the form of a number of balls, such conditions favour the maximum production of prussic acid inside these balls. If the meal in this form is not properly chewed the balls of meal will break up in the stomach and there liberate the poison.

Boiling water will destroy the enzyme, thus preventing the formation of prussic acid. In preparing the meal for calves or sick animals, therefore, *the linseed should be actually boiled with water* (thus removing all risk of prussic acid formation), or else well mixed with twenty times its weight of water which is absolutely boiling at the time, when the chance of poisoning is too remote for practical consideration. Not more than 1 lb. of linseed should be mixed with a gallon of boiling water; ground linseed and linseed cake meal swell and froth a good deal with water, and the mixture should be carefully stirred until quite smooth.

It is of advantage to mix a little wheat flour with the linseed meal to counteract the laxative influence of the latter; the wheat flour will also supply some starch, produce a better balanced food, and will not swell so much with water as linseed meal does. Maize meal or oatmeal may be used instead of wheat flour if the laxative effect of the linseed is desirable.

THE PROGRESS OF THE LIVE STOCK INDUSTRY IN DENMARK.

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THE returns of the quinquennial census of Danish live stock taken on the 15th July, 1914, which were recently published by the Danish Statistical Department, include some interesting facts and figures, and show the increasing importance of live stock in the agriculture of Denmark.

Horses.—The total number of horses and foals on the 15th July, 1914, was 566,811. In 1909 the figures were 535,018. These figures show an increase of some 32,000, or about 6 per cent. in 5 years. The classification as regards age and sex in 1914 and 1909, respectively, was as follows :—

	1914.	1909.
Stallions, 3 years or over	4,157	3,865
Geldings, 3 to 6 years	53,858	51,687
„ 6 to 11 years	80,721	74,379
„ 11 years and over	54,492	48,596
Total	189,071	174,662
Mares, 3 to 6 years	66,394	59,327
„ 6 to 11 years	96,992	95,185
„ 11 years and over	73,835	70,347
Total	237,221	224,859
Colts, 1 to 2 years	48,909	48,352
„ 2 to 3 years	38,084	33,947
Total	86,993	82,299
Foals under one year	49,369	49,333
Grand Total	566,811	535,018

The figures indicate a greater increase for geldings than for mares, and, of the five groups, those comprising the youngest animals (*i.e.*, colts and foals) show the least increase.

The effective working strength of Danish horses has increased a good deal more than is revealed by the figures quoted. Excluding stallions, the following are the percentages of increase according to age during the last 5 years :—

Under one year	0·1	per cent.	increase since 1909.
From 1 to 2 years ..	1·2	„	„ „
„ 2 „ 3 „ ..	12·2	„	„ „
„ 3 „ 6 „ ..	8·3	„	„ „
„ 6 „ 11 „ ..	4·8	„	„ „
Over 11 years	7·9	„	„ „

In general, Danish horses are of the draft type. The native breeds are known as the Jutland and the Fredericksborg. Of the foreign breeds found in Denmark the Belgian and the Oldenburg (German) are the favourites. There are few thoroughbred animals in Denmark. The following figures show the increase in the number of horses since 1861 :—

1861	..	..	325,000	1898	..	..	449,329
1881	..	..	347,561	1903	..	..	486,935
1888	..	..	375,533	1909	..	..	535,018
1893	..	..	410,639	1914	..	..	566,811

Of late years, numbers of ponies have been imported from Iceland and Russia by the Danes. These ponies, which are all under 15 hands in height, might be called the small holder's horse. In 1898 there were 26,000 foreign ponies in Denmark, but since then their number has been more than trebled, there being 87,000 such ponies in Denmark on the 15th July, 1914. About 65,000 of these were Russian, 14,000 were from Iceland and the remaining 8,000 were unclassified.

Cattle.—The great dairy movement of the 'eighties proved to be the turning point in the economic welfare of Danish agriculture, and the following table, which shows the increase in the number of cattle since 1881, will, therefore, be of interest.

Year.	Cows of two years and over.	Calves and young stock under two years.	Bulls.	Bullocks.	Total.	Number of cattle per 1,000 acres under cultivation.*	Number of cattle per 1,000 of population †
1881	898,790	458,743	17,959	94,598	1,470,078	210	736
1888	954,250	435,988	14,980	54,309	1,459,527	208	681
1893	1,011,098	603,919	17,954	63,194	1,696,190	242	762
1898	1,067,265	628,025	15,324	34,183	1,744,797	250	731
1903	1,089,073	699,354	14,528	37,511	1,840,466	263	734
1909	1,281,974	840,750	73,039	58,219	2,253,982	322	834
1914	1,310,268	988,554	95,568	68,472	2,462,862	352	861

* There are nearly 7 million acres of land under cultivation in Denmark.
† The population of Denmark increased from 1,995,000 in 1881 to 2,859,000 in 1914.

In the course of the last 33 years the total number of cattle has increased by about 992,780 head or 67½ per cent. When the first cattle census was taken in 1837 there were only 858,000 head of horned cattle in Denmark, so that the number of cattle in 1914 was nearly three times that of 1837. In round figures it may be said that between 1837 and 1870 the average increase was about 9,000 head annually; and from 1870 to 1881 it was 20,000 head annually. Between 1881 and 1888 the average annual increase dwindled slightly, but from 1888 to 1893 it approached the high figure of 50,000 head. This was chiefly due to the great extension of dairying which occurred during the period. From 1893 to 1898 the average annual increase was about 10,000 head, and from 1898 to 1903 about

20,000 head. The increase between 1903 and 1909, *i.e.*, an average of 70,000 head annually, surpassed all previous records, while the increase during the last 5 years (40,000 head per annum), although not so great as that of the preceding 5 years, constitutes, nevertheless, a very satisfactory record.

In 1881 the number of cattle per 1,000 acres of land under cultivation was 210, while in 1914 it was 352, an increase of 142 head per 1,000 acres, or nearly 68 per cent. in 33 years. In 1881 the number of cattle per 1,000 of population was 736, while in 1914 it was 861, an increase of 125 head per 1,000 of population, or 17 per cent. during the period.

Dairy Cows.—Of the total number of Danish cattle in 1914, no fewer than 1,310,268 were either cows or heifers that had calved for the first time. These figures show an increase of 28,294 or 2·2 per cent. in the last 5 years. As the following figures show, many very important changes have taken place with regard to the ages of the dairy cows during the last 5 years :—

Age.	1914.	1909.	Remarks.
Under 3 years ..	220,020	700,557	14·1 % increase.
From 3 to 6 years ..	579,302		
From 6 to 10 years ..	429,434	484,343	12·8 % decrease.
Ten years and over ..	81,512	97,074	19·1 % ,,
Total ...	1,310,268	1,281,974	2·2 % increase.

It will be noted that the number of young cows has increased very considerably, while there has been a sharp decline in the old cows during the period. The increase of all the groups (28,294) is mainly due to the fact that 15,562 old cows over 10 years of age and 54,909 from 6 to 10 years of age were fattened and sold and the total (70,471) replaced by 98,765 young cows less than 6 years old. This replacement of old cows by young ones is an important result of the keeping of milk records, which aim at getting rid of the old, badly-paying cows having low percentages of fat in their milk, and replacing them with young, vigorous stock having high percentages of fat in their milk. The following table gives an idea of the extent to which this policy has been carried out since 1898 :—

Age.	1898.	1903.	1909.	1914.
	Per cent.	Per cent.	Per cent.	Per cent.
Under 6 years ..	83·5	43·4	54·6	61·0
From 6–10 years ..		42·2	37·8	32·8
Over 10 years	16·5	14·2	7·6	6·2

Sixteen dairy cows in every hundred were over 10 years old in 1898, while in 1914 the percentage of cows over the age of 10 years was reduced to 6. In 1903 a little more than two-fifths of the cows were under 6 years of age; in 1914 three-fifths were under 6 years of age.

The official dairy report published in 1913 gives particulars of the production of 722 dairies, or about two-thirds of the Danish co-operative dairies. The following table shows the average yearly milk yield per cow during the 5 years ending 1913, together with the average quantity of milk required to produce 1 lb. of butter :—

Year.	Average annual milk yield per cow.		Lb. of milk to 1 lb. butter.
	in lb.	in Imp. gals.	
1899	*4,764*	*467·0*	*26·3*
1909	5,816	570·0	25·3
1910	5,657	556·6	25·6
1911	5,792	568·0	25·5
1912	5,558	545·0	25·6
1913	5,690	558·0	25·5
Average *1909–13*	*5,703*	*560·0*	*25·5*

Comparing the average yield of 1899 with that of the 5 years 1909-13 the figures indicate an increase of nearly 20 per cent. in the average milk yield per cow. This excellent progress demonstrates in a striking manner the economic value of the keeping of milk records. The decrease in the quantity of milk essential to the production of 1 lb. of butter is mainly due to the increase in the percentage of fat in the milk of the cows. If records are periodically taken, cows having a liberal milk flow with a high fat percentage are singled out, and the selection of such stock for breeding purposes, when persevered in, is bound to increase both the average milk yield and the average fat percentage, as the following records show :—

Cows.	Average milk yield in lb.	Fat in milk %	Average butter yield per cow.
			lb.
68,124 tested in 1903–04	7,044	3·41	267
124,668 tested in 1910–11	7,567	3·52	296
Average percentage of increase ..	*7·4 %*	*0·11 %*	*10·8 %*

Calves and Young Stock.—Of the 988,554 animals grouped under this heading, no fewer than 609,115 were calves, and 379,439 were heifers over one year that had not yet calved. The following table shows the relative figures for 1909 and 1914 :—

Age.	1914.	1909.	Increase.
			Per cent.
Calves under one year	609,115	486,781	25·1
Heifers over 1 year not yet calved ..	379,439	353,969	7·2
Total	988,554	840,750	15·7

These figures indicate that large numbers of young animals are available for drafting into the dairy herds. The most recent census form contained a question regarding the numbers of calves dropped between the 15th July, 1913, and the 15th July, 1914, together with an inquiry as to whether the calves had been sold, slaughtered, or had died during the year, or were alive on the census day. From the answers received it appeared that 1,144,000 calves were dropped in the period (*i.e.*, 87 per cent. of the 1,310,268 cows dropped calves). Of these calves 609,115, or 53 per cent., were living on the 15th July, 1914.

Bulls.—During the last 5 years the number of bulls has risen from 73,039 to 95,568, or by 31 per cent.

Age.	1914.	1909.	Remarks.
From 1 to 2 years	68,880	49,009	40·5 % increase.
„ 2 to 3 „ ..	22,771	19,736	15·4 % „
„ 3 to 5 „ ..	3,348	3,516	1·9 % decrease.
5 years and over	569	778	26·7 % „
Total	95,568	73,039	30·8 % increase.

A considerable increase in the number of young bulls has taken place during the last 10 years. In 1914, 72 per cent. of the bulls were under 2 years ; in 1909, 67 per cent. ; and in 1893, 57 per cent.

Bullocks.—With the advent of dairying the number of bullocks diminished rapidly ; in 1898 it dropped to 34,183. In 1914 their number was double that of 1898, but in spite of this there were only 28 bullocks in every 1,000 head of Danish cattle on the 15th July, 1914. The following table shows the ages of the bullocks in 1909 and 1914 :—

Age.	1914.	1909.	Remarks.
From 1 to 2 years	49,140	—	—
2 years and over	19,332	—	—
Total	68,472	58,219	17·6 % increase.

Sheep.—During the last 50 years the number of sheep in Denmark has steadily decreased, and in 1914 the number was little more than one-fourth of the total in 1861. The steady diminution is shown in the following figures :—

Year.	*Number.*
1866	1,875,000
1888	1,225,000
1898	1,074,413
1909	726,879
1914	514,022

Of the 514,022 sheep, nearly half were lambs under one year. The total number of lambs weaned between 15th July, 1913, and 15th July, 1914, was 353,000. As the lambs were dropped in spring, it may well be assumed that the majority of them (242,000 lambs) were returned when the census was taken in July, 1914. Of the sheep other than lambs, 21,000 were rams (in 1909 about 28,000), 16,000 wethers and hoggets (in 1909 about 27,000), and the rest ewes that had carried or were carrying lambs (in 1909 about 327,000). The number of flocks of sheep has decreased from 95,000 in 1909 to 71,000 in 1914.

Pigs.—None of the Danish domestic animals shows such fluctuations in numbers as pigs. These fluctuations are mainly occasioned by the ruling price of bacon. The following table gives the figures for the last 21 years, together with the number of pigs per 1,000 acres of land under cultivation and the number per 1,000 of population :—

Year.	Number of Pigs.*	No. per 1,000 acres of tillable land.	No. per 1,000 persons.
1893	829,131	118	372
1898	1,168,493	167	492
1903	1,456,699	208	578
1909	1,467,822	210	543
1914	2,496,661	357	873

* The large number of pigs is directly due to the large quantities of dairy offal (skim milk, whey, etc.) available.

The high prices obtainable for pigs in 1905–07 occasioned a considerable increase in the production. The export of bacon in 1908 exceeded that of any preceding year. A fall in the

price of bacon followed the big exports, accompanied by an advance in the price of corn, and the producers, finding their profits diminished almost to zero, slaughtered their sows in great numbers. Bacon prices improved in 1910, and with a passing fall in 1911 became firm again in 1912 and still firmer in 1913, and in consequence a large increase in the number of pigs was expected in July, 1914. The following table shows the bacon exports and prices* from 1905 to 1914 :—

Year.	Million lb. of bacon exported.	Average price per lb.
		d.
1905	175·9	—
1908	240·9	5·7
1909	209·4	6·7
1910	213·3	7·4
1911	252·1	6·4
1912	281·0	7·0
1913	278·6	7·8
1914	324·3	—

The census returns in 1914 fully confirmed the expected increase. No fewer than 2,496,661 pigs were found in Denmark on the 15th July, 1914, as compared with 1,467,822 in 1909. The increase during the 5 years was nearly 1,029,000 pigs, or 70 per cent. The increase during the last 21 years was 1,667,530 pigs, or 201 per cent.

As the foregoing figures do not bring out very well the actual state of pig breeding in Denmark the following division of the animals into four groups is essential in order to throw light on this point. The four groups are : breeding animals (boars and sows), bacon pigs, and young pigs :—

Group.	1914.	1909.	Increase.
			Per cent.
Boars from 4 months upwards ..	12,637	7,934	59·3
Sows from 4 months upwards ..	280,629	147,934	89·7
Total number of breeding animals ..	293,266	155,868	88·2
Bacon pigs 4 months old and upwards	707,973	422,439	67·6
Young pigs under four months ..	1,495,422	889,515	68·1
Total number	2,496,661	1,467,822	70·1

Of the four groups, that relating to breeding sows shows the greatest relative increase, viz., 90 per cent. The present position of Danish pig breeding is very favourable for a continuation of the intensive production that has been carried on of late years. It is expected, however, that the scarcity of

* Prices paid to the producer.

feeding stuffs and their high prices since the outbreak of the war will have a retrogressive effect upon Danish pig production.

The number of young farrowed by Danish sows between 15th July, 1913, and 15th July, 1914, was 3,964,000, or 1,413 young per 100 sows (14·13 per sow).

The number of herds of pigs increased between 1909 and 1914 from 188,000 to 208,000, an average increase of 4,000 herds per annum.

Poultry.—It is said that if poultry are intelligently bred and fed they are the most efficient transformers of raw material into finished product on the farm. The following figures prove that Danish farmers are keenly alive to the fact :—

Year.	Total number of fowls and chickens in millions.	Millions of dozens of eggs exported annually.	Average price per dozen paid to producer.	Number of fowls per hundred of population.	Number of fowls per 100 acres of land under cultivation.
1888	4·6	—	—	214	65·7
1893	5·9	10·0	8·4*d.*	265	84·3
1898	8·77	20·2	8·6*d.*	370	125·3
1903	11·56	32·64	9·4*d.*	450	165·1
1909	11·81	29·22	10·0*d.*	437	168·7
1913	15·15	36·0	10·8*d.*	529	216·4
1914	15·15	38·1	—	—	216·4

Since 1881, the number of poultry has been more than trebled. The number of eggs exported in 1914 was nearly four times that exported in 1893. The figures do not include the eggs sent from neighbouring countries to Denmark and re-exported. The price per dozen paid to the producer has improved 31 per cent. in the course of the last 25 years.

In 1909, 41·5 per cent. of the total number of poultry were chickens under 9 months; in 1913, 46·7 per cent. were chickens.

Goats.—Many of the Danish small holders keep goats for their children's sake, owing to the highly nutritive quality of the milk. The following analyses of goat's milk, cow's milk and human milk will make this fact more apparent :—

—	Water.	Solids.	Proteids.	Fats.	Sugar.	Ash.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Average of 43 analyses of cow's milk	87·64	12·36	3·72	3·46	4·42	0·76
Goat's milk ..	87·33	12·67	3·52	3·94	4·39	0·82
Human milk ..	87·02	12·98	2·36	3·94	6·32	0·45

Practically speaking, it may be said that the goat is almost free from tuberculosis, as only about 1 per cent. get the disease, and of these there are extremely few cases in which bacteria are found in the milk.

The following figures indicate the number of Danish goats since 1893 :—

	No. of Goats.		No. of Goats.
1893	25,266	1909..	40,257
1898	31,822	1914..	40,670
1903	38,984		

Most goat-keepers keep only one goat and few have more than two or three.

Asses are not bred in Denmark.

Statistics of Danish Crops.

In conjunction with the above statistics relating to the live stock in Denmark it may be of interest briefly to consider the other forms of agriculture practised in the country, *i.e.*, the extent to which the principal crops are grown, together with the yields obtained. The total area of Denmark, exclusive of lakes and rivers, is 9,468,000 acres, of which in 1912 woods and plantations, including public parks, occupied 822,458 acres, and crops and grass covered an area of 6,928,817 acres. The following table shows the area under certain crops in 1912 and the production in 1912, 1913 and 1914 :—

Crop.	Area in 1912.	Produce.		
		1912.	1913.	1914.
	Acres.	Qr.	Qr.	Qr.
Wheat	133,489	434,736	805,102	701,505
Barley	596,280	2,742,743	3,007,584	2,517,165
Oats	1,058,116	5,103,296	5,625,471	4,683,577
Rye	607,091	2,224,036	2,000,776	1,320,480
Mixed Corn, and Corn and Pulse ..	445,470	2,140,071	2,355,677	2,028,862
		Bush.	Bush.	Bush.
Potatoes	151,018	27,806,853	40,650,036	36,203,160
Carrots	19,767	12,323,130	10,940,500	11,169,060
Mangolds	206,870	200,873,563	191,155,599	200,245,290
Kohl-Rabi	253,373	159,223,397	215,850,625	177,577,050
Turnips (and other Fodder Roots) ..	166,750	137,590,719	137,900,575	116,119,710
		Tons.	Tons.	Tons.
Sugar Beet	79,954	970,161	915,054	951,000
		Tons of Hay.	Tons of Hay.	Tons of Hay.
Clovers and Grasses, for Hay	585,867	1,207,833	1,050,066	915,000
Clovers and Grasses, for Pasture ..	1,164,400	—	—	—
Lucerne	24,073	—	—	—
Meadows	546,221	751,899	717,650	679,000
Permanent Grass ..	256,255	—	—	—

The corn yield in 1914 was 14 per cent. less than the average yield of the foregoing 5 years 1909-13. The yield of roots in 1914 was about 3 per cent. below the average of the five-year period 1909-13.

The annual value of the Danish harvest, *i.e.*, cereals, potatoes, roots, hay, straw, &c., from 1875 to 1911, was as follows :—

Years.	Annual average in millions of £.
1875–78	19·0
1885–87	17·2
1894–96	20·2
1898–02	22·0
1903–07	28·0
1908–11	32·8

——	Average annual yield of the 5 years, 1909–13.	Yield of year 1914.	Proportional figures showing yield in 1914 when average of 1909–13 = 100.
	Qr.	Qr.	
Wheat	660,240	701,505	106
Barley	2,768,194	2,517,165	91
Oats	5,326,624	4,683,577	88
Rye	2,083,882	1,320,480	63
Mixed Corn and Pulse	2,279,891	2,028,862	89
	Bush.	Bush.	
Potatoes	32,159,190	36,203,160	113
Carrots	10,948,980	11,169,060	102
Mangolds	187,728,240	200,245,290	107
Kohl-Rabi	193,697,910	177,577,050	92
Turnips (and other Fodder Roots ..	131,002,620	116,119,710	89

THE COMPOSITION, STORAGE AND APPLICATION OF FARMYARD MANURE.

AN investigation into various problems connected with the making, storage and application of farmyard manure was begun some years ago by the West of Scotland Agricultural College, and although some questions still remain to be dealt with, a report* has been issued on the results so far obtained.

The conditions under which farmyard manure is made and used in the West of Scotland present certain points of special importance : The rainfall is higher than in districts in which the majority of the experiments with farmyard manure have hitherto been carried out (the rainfall at Kilmarnock, where

* West of Scotland Agricultural College, Bull. No. 65. *The Results of some Experiments with Farmyard Manure*, by R. A. Berry, F.I.C.

the present experiments took place, averaged 39·32 in. per annum in the 13 years 1901–13), thus leading to an increased loss by drainage of the soluble manurial constituents; again, cow manure forms a large proportion of the manure made in the West of Scotland, and the food rations from which it is made vary considerably; and, further, the soils are generally poor in lime, and the mean summer temperature is lower than that prevailing on the average in Great Britain, these factors possibly affecting the vigour and the types of bacterial flora of the soil, and therefore the decay and rate of exhaustion of the manure in the soil, and consequently the crop yields.

Storage under Cover and in the Field.—The loss in weight in large (8-ton) heaps of freshly-made cow manure between 25th November and 4th April was found to amount, on an average, to 17·5 per cent. when stored under cover, and to 20·6 per cent. when stored in the open. The loss of total nitrogen in manure stored in the open was 28·4 per cent., or 8 per cent. more than the loss in the manure stored under cover. The ammoniacal nitrogen formed the principal source of loss of nitrogen in the manures; in each case it amounted to over 70 per cent. of that originally present. As regards potash and phosphates, whereas storage in the field resulted in a loss of 21·1 per cent. of the phosphoric acid* and 28·3 per cent. of the potash*, there was practically no loss of these ingredients in the manure stored under cover. Drainage thus accounted entirely for the loss of mineral substances and also for the loss of soluble proteid nitrogen and some ammoniacal nitrogen, but since the loss of the latter substance was much the same under both methods of storage, it is evident that the main loss of ammonia and its compounds must be due to causes other than drainage. The loss due to fermentation was ascertained later (*see* p. 134).

The two kinds of manure were used in the same quantities for potatoes and turnips, and it was found that the average percentage increase of crop resulting from manure stored under cover over the increase from manure stored in the open was 7 per cent.

Storage of Different Kinds of Fresh Manure in Exposed Heaps in the Field.—Five kinds of manures were tested in this experiment, *viz.*, cow, pig, bullock, and horse manure made with straw and horse manure made with peat-moss litter. The average loss in weight of these five kinds, when stored in the

* These large amounts were due to the large proportions soluble in water—*e.g.*, the phosphoric acid was 42 per cent. soluble and the potash 76 per cent. soluble.

open (in 4-ton heaps) from 18th December to 22nd April, was 22·3 per cent. The loss was considerably reduced with peat-moss litter in place of straw. Of the fresh manures, those from fattening bullocks and from horses with peat-moss litter were richest in soluble and available compounds of nitrogen, in phosphoric acid, and in potash soluble in water; next in order were the manures from cows, pigs, and from horses with straw litter. By using peat-moss litter in place of straw litter a larger proportion of urine is absorbed and the fresh manure thereby increased in value.

The average loss of manurial constituents during rotting was:—Total nitrogen, 29·6 per cent.; total phosphoric acid, 12·2 per cent.; total potash, 33·5 per cent.; and organic matter 32 per cent.; the main source of loss of nitrogen being again in the form of ammonia.

A comparison of the composition of the fresh and rotted manures showed the two fresh manures richest in compounds of nitrogen to be left poorest in these compounds after rotting, and *vice versa*, so that it would not appear to be economical to feed cake to enrich the manure, especially in nitrogen, if the manure is to be stored some time before it is used.

The average effect of rotting was, without exception, to lower the value of the manure for manurial purposes, if the value of the manure depends upon its power of supplying available manurial constituents—*e.g.*, the rotted manures contained in the total nitrogen on an average 4 per cent. of ammoniacal nitrogen, and 82 per cent. insoluble compounds, compared with 15 and 72 in the fresh; also, the rotted manure contained 44 per cent. of its phosphoric acid and 71 per cent. of its potash soluble in water, compared with 53 and 76 in the fresh manure.

When equal weights of the rotted manures were applied to a potato and to a turnip crop the increased yield of crop corresponded very closely with the supply of the compounds of nitrogen in the manure, as determined by chemical analysis; and the results of the experiment indicate that, where farmyard manure is used on soils of average fertility, the chemical analysis of the manure, showing the percentage of the different forms of nitrogen, and of the phosphoric acid and potash soluble in water, is a reliable guide to its manurial value.

Treatment of Farmyard Manure during Storage.—The precautionary measures to be taken to prevent undue loss of nitrogen in farmyard manure by *drainage* are fairly obvious, *viz.*: (1) The absorption and retention of as much of the urine

as possible by employing suitable litter; (2) the collection and preservation of the unabsorbed urine in tanks; and (3) the protection of the manure from rain and the leaching action of drainage water; and the experiments were, therefore, practically confined to comparing the methods of preventing undue loss of nitrogen by *fermentation*.

The most effective method found was to trample the manure and to cover it with a 3-in. layer of soil. The conditions causing loss of nitrogen were thus controlled and the loss reduced to a minimum; there was, in addition, an increase in the more available forms of nitrogen. The nearest approach in practice to these conditions is to allow the manure to accumulate in a sodden condition under the feet of the animal, such as occurs in a loose-box, or to draw up the loaded carts on to the top of the manure heap where it is being made in the field.

The least effective method of preventing loss of nitrogen by fermentation was found to be to leave the manure loosely packed; in such conditions the changes resulting in the destruction of organic matter and the breaking down of the complex forms of nitrogen were accelerated. Such conditions commonly occur in practice—*e.g.*, when the manure is carted daily from the byre, piggery, or stable on to a heap without any attempt at consolidating the loosely-packed mass.

Various substances were tried to fix ammonia, and of these gypsum and sodium acid sulphate proved the most efficient, while superphosphate of lime, kainit and carbonate of lime increased the loss of nitrogen. Antiseptics were also added to the manure to check fermentation, and of these chloroform acted best, followed by bleaching powder and formalin. The reduction in the loss of nitrogen, where such occurred, was, however, not sufficient in any case to repay the cost of the substance used.

The Time and Method of Application of Farmyard Manure to the Land.—These experiments were carried out with potatoes and turnips in two four-course rotations, *viz.*, potatoes, wheat, seeds and oats, and turnips, barley, seeds and oats. The application of fresh manure (20 tons per acre) broadcast to the soil in the autumn produced an average increased yield of roots of 25 per cent. When the fresh manure was stored until the spring, and the residue of the 20 tons then applied in drills to the root crops, an average increased yield of 42 per cent. was produced, whilst when the manure (20 tons) was applied fresh in drills in spring the average increased yield was 56 per cent. About 9 per cent. of the increase for root crops of

the drilled manures was due to the method of applying the manure in drills over that of broadcasting. In the case of the autumn application of the manure, when the manure was applied to turnips, there was a 5 per cent. increase in favour of ploughing in the manure at once, compared with leaving the manure on the surface some time before ploughing it in; where the manure was applied to potatoes, however, there was not much to choose between the two practices.

The yield of the root crops from the manure, whether applied in the fresh or rotted state in the spring, coincided with the richness of the manure, as indicated by its chemical composition in the more active compounds of nitrogen.

The manurial residues from farmyard manure were considerably affected according to (*a*) the root crop to which the manure was applied, and (*b*) the time of application of the manure.

The manure applied to potatoes left a residue which produced an increase amounting on an average to 50 per cent. of the total increase produced from the manure by the four crops, including potatoes, in the rotation, whereas the manure applied to turnips left a residue amounting to 34 per cent. of the total increase for the four crops in the rotation. Moreover, the residue in the former case persisted and was not exhausted at the end of the rotation, whereas in the latter case its effect was hardly visible after the second crop.

The residues left from the manures applied in the autumn were, as a rule, distinctly greater than the residues left from the same weight of manure applied in the spring. In the former case the increases due to manure residue amounted, on an average, to 57 per cent. of the total increase produced by the manure, whereas in the latter case they amounted to 34 per cent. of the total increase.

Of the nitrogen supplied in the manure, that recovered in the root crop amounted on an average, for potatoes and turnips, to about 9 per cent. from the autumn applied manure, and to about 18 per cent. from the spring applied manure. For the whole rotation the amount of nitrogen recovered in the crops was not on the average much more than 30 per cent. of that supplied in the manure. Although more nitrogen was taken up by the crop than appeared to be directly available in the manure at the time of its application, considerably more than one-half the nitrogen added in the manure was unaccounted for.

A NEW VARIETY OF HOP— THE "FOUNDLING."

E. S. SALMON, F.L.S.,

Mycologist to the South-Eastern Agricultural College, Wye, Kent.

AMONG the hops growing in the Experimental Hop-garden at Wye College, one plant attracted attention in 1906 and 1907 by its vigorous growth and prolific cropping qualities. It was decided to test this hop further; "cuts" were taken from the hill, and in 1908, 38 hills were planted in a row in the main hop-garden at Wye College. From 1908 to 1914 these hills have been under observation, and the following facts appear to be of sufficient commercial importance to merit the attention of hop-growers. As noted below, the hop appears to be distinct from all varieties of cultivated hops, and the writer has given it the name of the "Foundling."*

Disease Resistance.—The hop has proved remarkably resistant to the attacks of the disease popularly known as "nettle-head," "skinkly," or (in Sussex) "silly hill." This disease, which has been attributed to the attacks of an eelworm (*Heterodera schachtii*), is sometimes the cause of serious loss to the hop-grower.

No certain remedy against "nettle-head" is at present known, and it follows, therefore, that the constitutional resistance of a variety of hop to the disease is a matter of importance.

The immunity from, or resistance to, "nettle-head" disease, possessed by the "Foundling" hop became evident under the following circumstances. A row of 38 hills of the "Foundling" was planted, and on either side of this, rows (of a varying number of hills) were planted with "cuts" from hills of other promising varieties in the nursery. The rest of these rows consisted, like the hop-garden generally, of the originally planted hills of the Canterbury White-bine variety. It soon became evident that an attack of "nettle-head" disease was developing in this part of the garden. In 1909, 1 hill, and in 1910, 5 hills near the "Foundling" row were attacked. In 1911, 10 hills were badly affected and had to be grubbed up, 4 of these hills being in the rows adjoining the "Foundling." Notwithstanding the fact that each affected hill was grubbed up as soon as the disease was noticeable, the attack increased in

* The plant, of which only one "hill" existed, was one among a number of different kind of hops of which no record existed as to name or origin.

FIG. 1.—Photograph of a part of the row of the "Foundling" hop in the hop-garden at the South-Eastern Agricultural College, Wye, Kent.

severity during the next two seasons; in 1912, 28 hills were destroyed, 20 being in the rows adjoining the "Foundling," and in 1913, 44 hills were destroyed, 15 being in the rows adjoining the "Foundling." During 1914 the spread of the disease continued, 43 fresh hills being affected in the various rows. During 1914 a male hop which had been interplanted in 1909 in the row of the "Foundling," and which up to that year had been extremely vigorous, showed in early summer evident signs of the disease, and although the bines managed to reach to the top wire, they were so seriously affected that no flowers were produced. From 1909 to 1914, therefore, 131 out of the 228 hills planted in rows on either side of the "Foundling"—that is to say over 57 per cent. of the hills—have been so badly affected by the disease that they have had to be grubbed up. So much damage, indeed, has been done that the whole of this corner of the hop-garden (with the exception of the "Foundling" row) has had to be grubbed up and replanted.

During this period of 6 years, however, not a single hill of the "Foundling" has been affected, although the row extends through obviously infected ground. This immunity was the more striking in that the roots of the "Foundling" hills were found, on examination, to be infested by the "eelworm" in large numbers.

With regard to resistance to other diseases, it would appear that the "Foundling" is not liable to severe infestations of "blight" (*Aphis*); it is, however, about as susceptible to "mould" (*Sphærotheca humuli*) as most varieties of hops.

General Characteristics.—The growth is very vigorous; the bine is green, with blotches (often inconspicuous) of dark green or red, and is very fruitful. It is a late hop, ripening about ten days later than the Canterbury White-bine. In the medium hop soil of the College hop-garden the crop in an average season is about 15 cwt. to the acre; in 1914 the hills yielded at the rate of 22 cwt. to the acre. In richer hop soil at Chilham, Kent, 3 older hills and 22 hills in their second year bore in 1914 at the rate of 18 cwt. to the acre. The hops are small to medium in size, and hang very thickly on the laterals. Photographs of a part of the "Foundling" row in the College hop-garden, and also of separate hops, are shown in Figs. 1, 2, 4, and 5. In some respects the "Foundling" hop resembles the Colgate variety, though it is clearly quite distinct. Its distinguishing characters can be seen on referring to Figs. 3 and 6, which show the Colgate hop.

Flavour.—The reports of hop factors, hop merchants and brewers as to flavour and "rub" on samples (unnamed) of the "Foundling" hop submitted in 1907, and each season since 1910, have been as follows:—

1907. (Box sample.) "Good flavour" (Factor E).*

1910. 20 bushels of hops were picked from 35 hills planted with "cuts" in 1908–9; they were dried separately on the oast and put into a pocket. An ordinary commercial sample was cut from the pocket, and was reported on as follows:—"Comes below Canterbury White-bine; lacks refinement and has ranker flavour; has more 'rub' than a Cobb's Golding, and is decidedly superior to that" (Factor A); "is not a Golding; has rank flavour, which is the Colgate flavour pure and simple; should not be grown" (Factor B); "of *full* flavour, *not rank*—worth going on with" (Merchant D).

1911. 40½ bushels of hops were picked from 35 hills, dried separately and put into a pocket. An ordinary commercial sample was reported on as follows:—"Is not a true Colgate, but has a ranker flavour—probably belongs to the Colgate class" (Factor A); "a very nice flavour, inclined to the Colgate—a good hop" (Factor B); "has strong but *not coarse* flavour" (Merchant D).

1912. (Box sample.) "Quite good, mild flavour" (Factor A).

1913. (Box sample.) "Very nice flavour; should say was as good a hop as Fuggles" (Factor A); "poor in colour; good mild flavour; fair 'rub'" (Merchant D).

1914. Four samples were submitted from the following sources:—(1) Wye College hop-garden; commercial sample cut from pocket; (2) Wye College hop-garden; box sample; (3) Chilham, Kent (strong loam of some depth over chalk); box sample; (4) Midhurst, Sussex ("malm rock," *i.e.*, Upper Greensand); box sample (unpressed). The reports obtained were as follows:—Factor A reported: "In all the samples I detected the same flavour, which I should call rank, or even as having a certain 'rancidity'; (1), (2) and (3) I should class as equal; (4) has ultimately, deep down, the same flavour, but its aroma comes quicker; I should say the characteristic flavour of this hop is more developed in the Midhurst soil, while in the Kent soils it is more subdued." Factor B reported: "(1), (2) and (3) have all the same flavour, which is mild; an inferior hop; (4) a much stronger flavour and a better hop; it could not be recognised as the same hop as in (1), (2), (3)."

Brewing trials of the hop were made in 1910 and 1911 at two different breweries. The first brewery reported that the results in a bitter beer were not quite satisfactory; it was suggested that the hops would no doubt be suitable for lager

* The same letter designates the same judge in the different seasons.

FIG. 2.—A branch of the "Foundling" hop.

FIG. 3.—A branch of the "Colgate" hop.

beer; and the opinion was expressed that if this variety of hop possessed good cropping qualities it would, on account of its richness in resins, be worth growing. The second brewery reported that the hops, on chemical analysis, proved second in percentage of resins of all the samples of hops tested that year at the brewery, and that, therefore, they could be considered quite up to the average of the year's hops in preservative value; further, that though not a bright-looking sample, the hops were well grown out and of a thick appearance. In the brewing trials the flavour was not considered delicate enough for pale ale, but the opinion was expressed that the hop might be useful to replace foreign hops in those breweries where the latter are used. The opinion of a third brewery on the four samples of 1914 was as follows:—"None gives the old Golding flavour—in fact, we think them all tainted more or less with the Oregon aroma. We prefer (1) and (2), and think that (1) has the most delicate and truer hop flavour; we consider (3) has a considerable vegetable aroma, and condemn it; (4) is the rankest and not suitable for the best light ales. We are quite satisfied with (1) and (2) for ordinary running beers."

Resin Production.—Chemical analyses, using the Bryant and Meacham process (slightly modified),* to ascertain the percentage of soft resins, have been made during the past four seasons of samples of the "Foundling" growing in the College hop-garden. The figures are as follows:—

		A, per cent.	B, per cent.	Average, per cent.
1910	——	10·51	8·98	9·75
1911	——	9·78	10·48	10·13
1913	——	11·40	12·74	12·07
1914	Sample (1) ..	12·44	11·49	11·96
"	" (2) ..	11·44	10·99	11·21
"	" (3) ..	9·84	10·92	10·38
"	" (4) ..	11·08	11·92	11·50

Reviewing the above data as to the brewing value of the "Foundling," it seems clear that it does not possess the true "Golding" flavour, and that it is not suitable for the best pale ales. In those cases, therefore, where the hop-grower finds it more profitable to grow only those varieties of hops which possess the delicate "Golding" flavour, it would not be advisable to plant the "Foundling." Where, however, such is not the case, it would seem that the "Foundling" is

* See *Journal of the South-Eastern Agricultural College* (Wye), Vol. XIX., (1910) p. 375.

worthy of a trial by the commercial hop-grower, since, as regards flavour, it appears to be suitable for some kinds of beer, and possibly for lager. With regard to resin production, if 10 per cent. of soft resins be taken as indicating a satisfactory hop, the "Foundling" stands above the average, and may claim, therefore, to be a powerful "copper" hop.

Summary.—The "Foundling" seems worthy of trial by the commercial hop-grower on account of the following characteristics :—

(*a*) Good cropping qualities.
(*b*) High resin production.
(*c*) Marked resistance to, if not total immunity from, the "nettle-head" disease.
(*d*) Lateness of season (coming after the "Fuggles").

Hop-growers in Kent, Surrey or Sussex can obtain 25 "cuts" of the "Foundling," free of charge, on application before November in any year to the Secretary, S. E. Agricultural College, Wye, Kent. Hop-growers in other counties can obtain sets from those farmers in Kent, Surrey or Sussex who are already growing the "Foundling," a list of whom will be forwarded on application to the College.

RABBIT BREEDING ON SMALL HOLDINGS.*

P. E. WILSON.

In order to derive the best possible results from table-rabbit farming, it is important that, in addition to selecting the right breed, the rabbits should be housed in a satisfactory manner. In the case of the small breeder live stock is too often kept in very insanitary surroundings; rabbits are special sufferers in this respect, and are often found stowed away in dark and foul-smelling boxes. However limited the available space may be, there is no excuse for this state of affairs, and the importance of keeping rabbits in healthy surroundings cannot be too strongly urged upon the small holder.

Systems of Housing.—There are two main systems of housing rabbits, *viz.*, (1) in stack hutches, and (2) in movable hutches.

* The information given in this article is supplementary to that contained in the article on "Utility Rabbit Breeding for Small Holders," published in this *Journal* for March, 1911, p. 982.

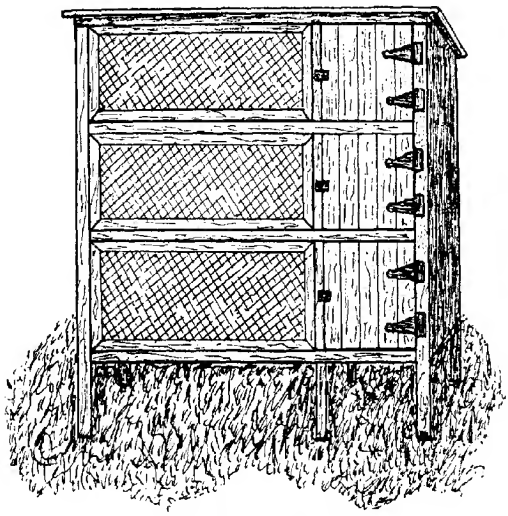
FIG. 4.—A branch of the "Foundling" hop.

FIG. 5.—Hops, the "Foundling."

FIG. 6.—Hops, the "Colgate."

For all-round use the first-named kind of hutch is undoubtedly superior, and is recommended, for reasons that are mentioned below.

The old fashioned stand hutches were often very ponderous structures, difficult to clean, and taking up a great deal of room. This class of hutch is now obsolete, and the type known as the stack hutch has completely taken its place. The stack hutch may be regarded as the standard modern hutch, as it is more than likely that any further improvements will be merely modifications and adaptations of the same principle.



The Stack Rabbit Hutch.

Briefly, the stack hutch is an arrangement of three or four tiers of hutches placed one over the other. The advantages of stack hutches are as follows :—(1) They take up very little room; (2) they provide ample light and abundant ventilation; (3) they are labour-saving, since all the rabbits are more or less together in one spot; and (4) they are economical in construction, the floor of the second hutch serving as the roof, or top, of the one underneath. It will also be apparent that, by reason of the design, they are economical in material.

A very common mistake that is made by a great many rabbit breeders is to make use of hutches of inadequate size. Of

course, the size must depend to a certain extent on the breed of rabbit, and the purpose for which it is kept, but for the utility breeder, who keeps the largest breeds of rabbit, hutches of adequate size are essential. Suitable measurements are as follows :—Total length of each hutch 6 ft., from which a space 1 ft. 6 in. should be boarded off (leaving a door in the partition for the rabbit to go in and out at will) to serve as the nesting compartment ; height 2 ft., width 2 ft.

It will be noticed that the hutches are comparatively narrow, but the width suggested gives ample space, owing to the length, and it will be found far better to have a hutch 6 ft. by 2 ft. than one more nearly approaching a square.

The actual number of tiers in a stack is more or less a matter of taste, but, for general use, three will usually be found the most convenient, the lowest being raised off the ground a little. As each hutch will be 2 ft., the whole stack will be about 6 ft. high. If these hutches are to be used in the open air, the roof must slope from front to back, to allow a proper fall during wet weather.

The small holder may either buy his hutches ready-made, or make them himself. The choice is largely a matter for his own consideration, and must depend upon the facilities at hand for obtaining the necessary materials at a moderate cost, and also upon his own skill as a rough carpenter.

A really good practical hutch at a moderate figure can be purchased ready for use ; the style and measurements are similar to those just described, and the illustration on p. 141, showing a stack of three hutches, will give the reader an idea of its appearance. These hutches are made in stacks of three and six hutches, and if they are built in sections to facilitate transit, they can be easily re-erected on arrival.

As regards the construction of hutches on the small holding itself, Mr. H. G. Read, a member of the Committee of Management of the British Table Rabbit Association, makes the following interesting observations :—

" I find small holders and farmers are usually handy with their tools, and utilise such spare wood or boxes as they can get cheap locally. They want no instructions in detail, only the suggestions of style, etc. The cheapest and easiest way is probably to make three wide shelves right across a stable or shed, build in a framework in front, and then make movable wire fronts and wooden partitions. One thus gets two rows of hutches. The fronts are fastened in with buttons, or better still by small pieces of wood dropping over the front."

This is a simple way of making a stack of hutches, which will doubtless appeal to many. The wire netting door of the run, and the wooden door of the nesting compartment could be hung in the usual manner with hinges, if preferred. The wire doors (covered with 1 in. wire netting) can be hung at the top, side, or bottom as preferred; the wooden doors are hung at the side.

There is, of course, a wide difference of opinion as to the respective merits of housing the rabbits under cover or in the open air. It is difficult to give a definite opinion on the subject, though the writer prefers the indoor system, provided that the stock are well housed, and are kept clean and healthy. In a good shed or building, breeding can proceed regularly throughout the year; in stormy weather, and on dark nights and mornings, it is obviously more comfortable to attend to small stock under cover; and, in addition, the warmth and shelter of a building naturally favour fattening. Taking these several points into consideration, it would appear that the indoor method is the superior.

In building hutches, the framework and boarding should be as strong and well-seasoned as possible, and this, of course, specially applies to outdoor rabbit farming, where the hutches have to withstand our very variable climate. For outdoor use, the sloping roof, previously mentioned, should be covered with tar felting.

A substantial hutch can be made by using a strong deal framework 1½ in. to 2 in. thick, and the same width, and ¾ in. tongued and grooved boarding. The wooden framework for the wire netting doors should be composed of 2 in. by 1 in. deal framing, firmly mortised and tenoned. It must be remembered that there is a great deal of wear and tear on the doors, so that it pays to have them really well made at the outset. Good materials will save a constant series of repairs, and, though more costly at the start, the small holder will find them far cheaper in the long run.

In the Movable Hutch System the rabbits are kept on the ground, and out of doors. The hutches should be 6 ft. long, 2 ft. wide, and 1 ft. 8 in. high in front, the roof sloping slightly to the back. The floor consists of 1½-in. wire netting, and at one end there is a raised wooden floor 1 ft. 6 in. long for the nesting compartment. The front of the hutch is half wire netting and half wood, and to provide protection there is a sliding wooden shutter running between a rail at the top and bottom of the hutch. The door is in the roof, and should

be of good size, to allow plenty of room for cleaning the inside of the hutch and for feeding. These hutches are only suitable where there is grass land. The herbage, of course, protrudes through the wire netting floor, so that the rabbits can readily crop it. They may (provided it is not wet weather) be moved to a fresh patch, morning and evening, and, in this manner, they get practically all their own green food; hand feeding must, of course, be carried out in the usual way.

The system is not to be recommended to anyone to take up extensively, as it is not satisfactory in winter. At the same time, during the spring and summer months, it is not a bad plan to have a few hutches to work over a grass orchard or piece of rough grazing land. The droppings from the rabbits have a beneficial effect on grass land, and increased crops will follow in places where rabbits have been kept on this system. It might assist many small holders to have a number of these hutches in use during the summer months, as they could then breed more stock.

It is really impossible to give any satisfactory details of cost where home-made hutches are concerned, as so much must depend on individual circumstances, and on the material available.

Rabbits should be bedded down on hay or straw. The small holder will probably be in a position to utilise rough grass (made into hay) for the purpose. It may be assumed that the value of the manure is a set-off against the cost of the litter, the manure being very much more valuable as a fertiliser than is often supposed.

If available, sawdust should be used liberally, as there is nothing better for soaking up the urine, and generally keeping the hutches in a wholesome condition. Sawdust should also be put underneath the litter in the nesting compartment. Failing sawdust, sand, sifted ashes, or dry earth may be utilised.

For cleaning out hutches, few implements are required; in fact, with the exception of a shovel and yard broom, all that is wanted is a metal scraper, a handbrush for sweeping out the floors, and a small shovel for the sawdust or other absorbent. The first consists of a metal handle and a crosspiece at the end about 2½ in. in width. The best brush is the ordinary hand banister brush, and for the sawdust an ordinary small coal scoop is sufficient.

Fattening Stock.—When weaned, the young rabbits may be moved for fattening into one of the ordinary stack hutches, or a greater number can be run together in larger and specially

constructed pens, either on the same principle, or on the ground, in a shed or other building. It is not desirable to keep a great number together; the best results are obtainable by transferring the young rabbits to pens made on the ordinary stack principle, but these could, of course, be made larger, in order to accommodate, say, 10-12 in each pen. The nesting compartments could be dispensed with. Some breeders obtain very good results by running a batch of young rabbits together in loose boxes, but care must be taken to exclude draughts and to avoid damp.

Selection of Utensils.—With regard to feeding utensils, there is probably nothing better than glazed pottery, but this is far too dear when saucers and troughs are required in numbers, and as a substitute red flower-pot saucers are very clean and satisfactory. For single rabbits a saucer of 7 in. diameter is advocated, but for a number of rabbits together saucers of 10 in. to 12 in. diameter should be used. Drinking water can be given in the same class of vessels. These saucers are sold by the "cast," the number of saucers in a "cast" varying with their size. For instance, there are 24 to a cast in the 7-in. size, but only 4 to a cast in the 12-in. size. The cost is about 2*s.* to 2*s.* 3*d.* per cast.

The utensils required for killing and dressing the rabbits may consist of the following:—A sharp-pointed "sticking" knife, a larger knife for dressing, a steel, a pair of scissors, two pails, a few cloths, a number of wooden skewers for ventilating the carcasses when dressed, and a selection of hooks to hang the rabbits on after the operation. To this list, however, must be added the highly important spring balance for weighing the carcasses. The killing knives can be procured at any shop making a speciality of butcher's implements.

Foods and Feeding.—With regard to the cost of feeding the small holder should—as a general rule—be in a good position for obtaining green food, as, apart from the common weeds that will probably be found on the holding, *viz.*, dandelions, plantains, hogweed, groundsel, charlock, dock, sow-thistles, cow-parsley, yarrow (all of which rabbits devour greedily), he will have available a large quantity of waste produce from market garden crops, cabbages, lettuces, turnips, carrots, etc., and, in addition, he will probably grow a certain amount of green food, such as mixed clovers and grasses, vetches, or rape.

The meals and grain required for feeding are not likely to be purchased specially for the rabbits, but will be bought in bulk for the use of other stock; these foods include bran, middlings, barley meal, and oats. It is obvious that the rabbit keeper who has available a plentiful supply of green food, and can buy his feeding stuffs in bulk, is in an advantageous position.

If rabbit breeding is carried on intelligently, and if due attention is given to the selection of stock, the system of housing, and the provision of a suitable and economic food supply, there is little doubt that it will prove profitable.

It is somewhat difficult to obtain statements of accounts which have been accurately kept dealing exclusively with the production of table rabbits by the small holder, but it may be useful to give some rough indication of the financial aspects of production. The approximate cost of raising a rabbit to killing age under ordinary circumstances may be put at 10*d*. Assuming that the average rabbit scales 2¾ lb. dressed weight, and sells at 6*d*. per lb., the selling price would be 1s. 4½*d*., and the gross profit would be 6½*d*. These figures are only approximate, and must be used with the reserve necessary in such cases. A small holder can materially increase his returns by keeping his stock pure, and selling a proportion of the most promising rabbits for breeding purposes.

The Waste from Saw-Mills as a Source of Potash.

THE following note has been communicated to the Board by Mr. C. T. Gimingham, F.I.C., University of Bristol, Agricultural and Horticultural Research Station:—Since the outbreak of war various methods have been suggested for making up, to some extent, the deficiency in our supplies of potash manures caused by the cessation of the imports from Germany. Reference may be made in this connection to recent work on the value of the ashes from hedge-clippings, &c.,* and from waste forest produce.†

In addition to the potash obtainable from these sources there is a very large amount of material, of which little use is made, in the wood-scraps, saw-dust, and shavings from planing machines, &c., produced in enormous quantities in every saw-mill in the country. It is true that some of the

* E. J. Russell, *Jour. Bd. Agric.*, Vol. XXI., No. 8, November, 1914.
† See Leaflet No. 25, Board of Agriculture for Scotland.

wood-waste, in particular the saw-dust, is saleable as such in certain localities, and it is also true that the percentage of ash in the shavings and saw-dust, especially from some of the imported timbers, is very small. Even when allowance has been made for both these considerations, however, it remains a notable fact that there are vast quantities of wood available for conversion into ash.

1. In many saw-mills the wood-waste is already used as fuel, and the ash obtained usually either accumulates in a heap, and incidentally loses nearly all its potash by exposure to rain, or it is given away to anyone who will take it. In some few cases it is sold to a neighbouring farmer at a low price.

The writer has recently examined a number of samples of such ash. Some consisted of comparatively coarse material obtained from gas-producing plants, etc.; others were flue-dusts from boiler flues and chimneys. Flue-dust is the more valuable material, sometimes containing up to 10 per cent. of potash, constituting a manure of about the same value as kainit; it is always obtained perfectly dry, and is in a beautifully fine mechanical condition. The percentage of potash in a few of the samples was as follows:—

	Potash (K_2O). Per Cent.
Sample No. 4—Coarse Ash: combustion very complete ..	7·24
,, 5— ,, ...	5·08
,, 6—Flue-dust	9·11
,, 8— ,, ...	6·35
,, 9— ,, coarser than Nos. 6 and 8 ..	5·89
Average	6·73

2. In other mills a mixture of wood and coal is burned. If wood-ash were a saleable commodity, however, it would in many mills be possible to increase the use of wood in the furnaces.

3. In mills where the wood-waste is not used as fuel the quantity produced is often so great that its disposal is a matter of serious difficulty. Were there a demand for wood-ash, there is little doubt that many firms would find it worth while to install plants adapted to use wood as fuel either for steam-raising or gas-making. Moreover, in big towns where there are many large saw-mills turning out hundreds of tons of wood-waste every week, it might very well pay to set up special plant for burning the waste for the express purpose of ash production.

In view of these considerations it would seem useful to bring to the notice of both farmers and timber merchants the possibility of utilising wood-ashes, at least in their own localities, in place of kainit when potash manuring is contemplated. If even a small general demand sprang up and the collection of the material could be satisfactorily organised, it is possible that a considerable trade could be done.

With regard to the value of wood-ash and flue-dust obtained from saw-mill furnaces, it is important to remember that since timber is relatively poorer in potash than leaves, bark, twigs, etc., the material will, in the great majority of cases, contain less potash than similar ash obtained by burning the undergrowth and waste of forest and woodland. It will, therefore, constitute a somewhat cheaper and lower grade fertiliser. On the basis of the ordinary price of kainit, ashes, such as those of which the analyses are given, should be worth from 25*s.* to 50*s.* per ton; and since ash is almost purely a waste product, there is good reason to suppose that it could compete with kainit even in normal times.

Notes on Feeding Stuffs in May: From the Animal Nutrition Institute, Cambridge University.

THE table on p. 150 gives the prices per ton and per food unit of 33 feeding stuffs at London, Liverpool, Hull, and Bristol. The feeding stuffs are in general the same as those included in the lists already published in this *Journal** with descriptions and suggestions for use, to which reference should be made.

In the list given on p. 149 the feeding stuffs are arranged in order of price per food unit. Price per ton is not a reliable indication of the value of a feeding stuff. The true value of a feeding stuff depends on the amount of nutritive material which it contains as well as on the price per ton. In order to assess the value the price per food unit is calculated as follows: The percentages of digestible protein and fat are multiplied by $2\frac{1}{2}$, and added to the percentage of digestible carbohydrates. The sum gives the number of food units in 1 ton. By dividing the price per ton by this figure the price per food unit is obtained, and the price per food unit is a good index of relative value. Foods, however, should not be bought entirely according to their price per food unit, which takes no account of their suitability for special purposes. For instance, wet brewers' grains are at

* March, 1915, p. 1111; April, 1915, p. 52.

present the cheapest feeding stuff per food unit, but although they are excellent for some purposes they would not be a suitable food for stock turned out to grass. In selecting feeding stuffs from the list, therefore, it is necessary to choose

	s.	d.	
Brewers' grains (wet) ..	1	0¼	per food unit.
Soya bean cake	1	3¼	,, ,,
Coconut cake	1	4½	,, ,,
Maize gluten feed	1	4¾	,, ,,
Palm-nut kernel cake ..	1	6	,, ,,
Malt culms	1	6¼	,, ,,
Decorticated cotton cake ..	1	6½	,, ,,
Linseed cake, Indian ..	1	6¾	,, ,,
Brewers' grains (dry) ..	1	7½	,, ,,
Linseed cake, English ..	1	8	,, ,,
Wheat pollards	1	8	,, ,,
Wheat middlings	1	8	,, ,,
Wheat bran	1	9¼	,, ,,
Maize germ meal	1	9½	,, ,,
Distillery grains (dried) ..	1	9½	,, ,,
Cotton cake, Egyptian ..	1	9½	,, ,,
Rice meal, Burmese ..	1	10	,, ,,
Cotton cake, Bombay ..	1	10¼	,, ,,
Wheat sharps	1	10½	,, ,,
Peas, English dun	1	11	,, ,,
Beans, English	1	11	,, ,,
Wheat bran, broad	1	11½	,, ,,
Maize, Argentine	1	11¾	,, ,,
Maize, American	1	11¾	,, ,,
Beans, Chinese	2	0¼	,, ,,
Maize meal	2	2¼	,, ,,
Barley, English feeding ..	2	2¾	,, ,,
Peas, English maple ..	2	4¼	,, ,,
Peas, Calcutta white ..	2	11¼	,, ,,
Oats, Argentine	2	11½	,, ,,
Oats, English	3	1½	,, ,,

not that which is absolutely the cheapest, but the cheapest which is suitable for the purpose in view. This principle has been used in compiling the following rations :—

For Horses at Farm Work :—

4 lb. Sharps.
2 ,, Maize, crushed.
1 ,, Bean Meal.

Feeding Stuff.	Reckoned from digestible nutrients.		Approximate price per ton at the beginning of May.								Approximate price per Food Unit.			
	Nutritive Ratio.	Food Units.	London.		Liverpool.		Hull.		Bristol.		London.	Liverpool.	Hull.	Bristol.
			£ s. d.		£ s. d.		£ s. d.		£ s d.		s. d.	s. d.	s. d.	s d.
Soya Bean Cake	1 : 1'1	122'3	—		8 5 0		7 10 0		7 17 6		—	1 4	1 2½	1 3½
Decorticated Cotton Cake	1 : 1'3	126'3	9 10 0		10 0 0		—		—		1 6	1 7	—	—
Indian Linseed Cake	1 : 1'9	123'1	9 15 0		9 15 0		—		—		1 7	1 7	1 6	—
English Linseed Cake	1 : 2'0	120'1	9 17 6		10 12 6		9 5 0		9 12 6		1 7½	1 9½	—	1 7½
Bombay Cotton Cake	1 : 2'4	65'3	5 18 9		6 5 0		6 2 6		6 0 0		1 10	1 11	1 10½	1 10
Egyptian Cotton Cake	1 : 2'0	71'9	6 5 0		6 15 0		6 10 0		6 7 6		1 9	1 10½	1 9½	1 9½
Coconut Cake	1 : 3'8	102'6	6 17 6		—		—		7 10 0		1 3½	—	—	1 5½
Palm-nut Kernel Cake	1 : 4'0	83'5	6 12 6		5 12 6		—		6 10 0		1 7	1 4½	—	1 6½
English Beans	1 : 2'6	99'5	9 1 1		10 5 4		9 14 0		9 5 3		1 10	2 0½	1 11½	1 10½
Chinese Beans	1 : 2'6	101'2	10 0 8		10 14 8		10 3 0		—		1 11½	2 1½	2 0	—
English Maple Peas	1 : 3'2	97'2	11 2 3		—		11 16 0		—		2 3½	—	2 5½	—
English Dun Peas	1 : 3'2	97'2	9 17 4		—		8 17 6		—		2 0½	—	1 10	—
Calcutta White Peas	1 : 2'3	97'5	14 4 5		14 11 2		—		—		2 10½	3 0	—	—
American Maize	1 : 11	93'8	8 17 4		9 10 5		—		—		1 11	2 0½	—	—
Argentine Maize	1 : 11	94'2	9 2 0		9 6 8		9 4 4		9 11 4		1 11½	1 11½	1 11½	2 0½
Maize Meal	1 : 13	86'4	9 0 0		9 15 0		9 10 0		9 15 0		2 1	2 3	—	2 3
Maize Gluten Feed	1 : 3'3	121'6	8 7 6		—		—		8 10 0		1 4½	—	—	1 5
Maize Germ Meal	1 : 8'4	99'2	8 15 0		8 12 6		9 0 0		9 0 0		1 9½	1 8½	1 9½	1 9½
English Feeding Barley	1 : 7'8	83'0	9 0 0		—		9 5 6		—		2 2	—	2 3	—
English Oats	1 : 7'9	75'4	12 0 0		11 13 0		11 13 4		12 0 0		3 2½	3 1	3 1½	3 2½
Argentine Oats	1 : 7'9	75'4	11 12 1		10 16 0		11 12 0		10 13 8		3 1	2 10½	3 1	2 10
Malt Culms	1 : 3'6	69'9	—		—		5 0 0		5 12 6		—	—	1 5½	1 7½
Brewers' Grains (dried)	1 : 3'4	84'5	7 0 0		—		6 10 0		6 17 6		1 8½	—	1 6½	1 7½
Brewers' Grains (wet)	1 : 3'4	21'1	1 5 0		—		0 18 0		—		1 2½	—	0 10½	—
Distillery Grains (dried)	1 : 3'5	77'8	7 5 0		—		—		—		1 9½	—	—	—
Porter Grains (wet)	no analysis.		1 2 6		—		—		—		—	—	—	—
Egyptian Rice Meal	1 : 10'3	78'7	—		—		—		—		—	—	—	—
Burmese Rice Meal	1 : 10'3	78'7	7 5 0		7 0 0		—		7 5 0		1 10½	1 9½	—	1 10½
Wheat Middlings	1 : 5'3	93'4	8 0 0		—		7 10 0		—		1 8½	—	1 7½	—
Wheat Sharps	1 : 5'3	86'3	8 2 6		8 2 6		8 5 0		8 0 0		1 10½	1 11	1 11	1 10½
Wheat Pollards	1 : 5'3	81'9	—		6 17 6		—		—		—	1 8	—	—
Wheat Bran	1 : 5'3	77'5	6 15 0		6 17 6		7 0 0		7 0 0		1 9	1 9½	1 9½	1 9½
Wheat Bran (broad)	1 : 4'7	79'9	7 10 0		7 12 6		8 10 0		7 12 6		1 10½	1 11	2 1½	1 11

This should be mixed with damped hay chaff. It is understood that the horses will also get the usual allowance of long hay, which will, as the season advances, be gradually replaced by green fodder. The ration of meal may be increased up to 10 lb. per head per day if the horses are very hard worked, or if the green fodder is not leguminous. It may also be advisable to increase the ration for very large horses.

For Cattle finishing for Beef on Roots or Green Fodder.—Ration per 1,000 lb. live weight per day :—

6 lb. Linseed Cake.
3 „ Bean Meal.

If roots or green fodder are scarce, and can only be used in smaller quantities than usual, 2 to 4 lb. of rice meal may be added to the ration to take the place of the sugar in the roots.

For Cows turned out to Grass.—Ration per 1,000 lb. live weight, for a daily milk yield of about 2½ gallons :—

3 lb. Cotton Cake.

For very heavy milkers 1 to 3 lb. of coconut cake may be given in addition to the cotton cake. As soon as the grass no longer scours the cows, the cotton cake may be replaced by an equal quantity of coconut cake, which is much cheaper per food unit, but which lacks the binding properties of cotton cake.

For Calves for Baby Beef at Grass.—Ration per 250 lb. live weight :—

1 lb. Linseed Cake.
1 „ Bran.

This should be fed dry mixed with about a pound of hay chop. If the grass is poor, 1 lb. of bean meal may be added to the ration, and the hay chop may be increased to 1½ lb.

For Heifer Calves and Store Steers at Grass.—Ration per 250 lb. live weight :—

½ lb. Linseed Cake.
1 „ Bran.

This should be fed dry mixed with 1 lb. of hay chop. If the grass is poor the linseed cake may be increased to 1 lb.

For Ewes suckling Single Lambs on the Fold.—Ration per 150 lb. live weight :—

½ lb. Cotton Cake.

For Ewes suckling Twin Lambs on the Fold.—Ration per 150 lb. live weight :—

½ lb. Cotton Cake.
¼ „ Dried Brewers' Grains.
¾ „ Hay Chop.

For Lambs with Ewes as above to come out fat.—Ration per 75 lb. live weight :—

¼ lb. Linseed Cake.
¼ „ Bean Meal.
⅛ „ Bran.
⅛ „ Malt Culms.

This should be fed in troughs through "creeps," mixed with ¼ lb. seeds hay chop.

For Store Lambs.—Half the above ration.

For Ewes at Grass suckling Single Lambs.—½ lb. Whole Beans. If suckling doubles increase to ¾ lb.

For Lambs to come out fat off Grass.—

¼ lb. Linseed Cake.
⅛ „ Bean Meal.

This should be fed in troughs behind "creeps."

For Pigs.—

Growing Stores.—Sharps, amount according to weight of pigs.

Fattening Pigs.—

½ part by weight Sharps
⅓ „ „ Rice Meal
⅙ „ „ Bean Meal
} Amount according to weight of pigs.

Suckling Sows.—

½ part by weight Sharps
⅓ „ „ Bean Meal
⅙ „ „ Rice Meal
} Amount according to weight of pigs.

The Use of Forage Crops for Pig-Feeding.

IN view of the importance at the present time of maintaining and, if possible, increasing the stock of pigs in this country, it is desirable that, pending the usual autumn supplies of waste potatoes, "tail" corn and similar farm by-products, increased attention should be paid to the production of cheap summer feed suitable for pigs. In this connection the practice of growing forage crops for consumption by pigs, common enough in some countries, is capable of considerable extension in this country. It is not claimed that green food alone will do more than maintain the condition of pigs, but it will effect a considerable saving of meal and furnish excellent supplementary feeding during the earlier stages of fattening. It is necessary, however, that pigs should be allowed gradually to accustom themselves to this class of food. Happily the range of crops to choose from and the methods of utilisation are sufficiently varied to suit the circumstances of most pig-keepers. Forage crops may be utilised in the following ways :—

(1) folding or pasturing,
(2) soiling.

Folding or Pasturing.—Rape, red clover and lucerne are among the most suitable crops to grow for this purpose. Rape should be sown at the rate of about 3 lb. per acre in rows about 28 inches apart—at short intervals for sectional grazing—and should not be thinned, as it is desirable to prevent the formation of coarse stems. The pigs should be turned on when the crop is about 12 in. high. If not too closely grazed a second crop may be obtained in a favourable season. The rows serve the double purpose of obviating trampling and facilitating cultivation in preparation for a second growth. For sectional grazing hurdles or movable fencing will usually be found the most suitable means of confinement.

Red Clover (Leaflet No. 184) and Lucerne (Leaflet No. 160) may likewise be fed in sections, or, if circumstances permit, the pigs may be allowed to graze at large over the fields. Except, however, in the case of brood sows in the early months of pregnancy, and gilts to be used for breeding, facilities for extensive roaming are not desirable. Where shade and shelter are not available naturally, these must be provided.

It is estimated that an acre of rape or lucerne will keep from 12 to 20 pigs of 100 lb. live weight for 4 weeks, while 1 acre of red clover or lucerne will provide grazing for 10 such pigs throughout the season. A good "stand" of lucerne will probably keep more. It is, however, advisable not to

overstock lucerne but to mow the crop from time to time so as to encourage fresh succulent growth. Lucerne might often be grown in orchards, for pig pasture, with advantage both to pigs and trees. It is usually desirable to ring pigs before turning them out to pasture.

Soiling implies the cutting of the crop for consumption at the homestead. In this connection cattle-feeding yards, generally empty in the summer months, might be more widely used to supplement the special accommodation usually set apart for pigs.

Crops necessitating relatively little trouble or expense in growing, and suitable for soiling, include the following :—

Lucerne ; red clover ; rye ; vetches (pure), or mixed with a cereal or with rape ; rape ; and maize.

The following table gives the approximate times for sowing and using these crops :—

Crop.	Time of Sowing.	Time for Using.
Lucerne .. .. } Clover .. .. }	Spring of previous year	Throughout the season.
Rye	Autumn	April and May.
Vetches and cereal ..	Autumn	May and June.
Vetches, cereal and rape*	Early Spring	June and July.
Rape	April and May ..	July and August.
Maize	End of May	August.
Rape,* vetches and cereal	June	September and October.

* About 5 lb. per acre of rape should be sown broadcast and rolled in after the oat and vetch crops are well above the ground.

It should be clearly understood that the times stated above will vary according to climate and season. Full particulars concerning the cultivation of lucerne and red clover will be found in Leaflets Nos. 160 and 184, respectively. The cultivation of the other crops is dealt with in Special Leaflet No. 28. Notes relating to the comparative values of feeding stuffs are issued from time to time in the Board's *Journal*, and further detailed information as to the use and purchase of feeding stuffs will be found in the following Leaflets :—

No. 74.—The Composition and Properties of Concentrated Feeding Stuffs.

No. 79.—Rations for Farm Stock.

Special Leaflet No. 8.—The Utilisation of Cereal Offals and certain other products for Feeding Purposes.

Special Leaflet No. 10.—Pig-Keeping for Cottagers and Small Holders.

Special Leaflet No. 16.—Notes on Pig Feeding.

Sorghum.

THOUGH widely grown and much prized, in America, for feeding in the green state, Sorghum is little known in this country. During the past few years, however, experiments conducted in Essex by the East Anglian Institute of Agriculture have indicated that two species of Sorghum, viz., *Sorghum vulgare* and *Sorghum saccharatum*, may prove distinctly useful additions to the forage crops of the warmer parts of this country.

In general appearance and habit of growth Sorghum resembles maize; its stem, however, is much more slender, and it has a narrower leaf. Its requirements as regards soil and climate appear to be almost identical with those of maize. Like maize, also, it thrives in abundant sunshine, and is easily killed by frost.

Soil.—The character of the soil is of less importance than its mechanical condition. Sorghum possesses an extremely well-developed root system, and is capable of resisting drought. The soil, however, must be well drained, the sub-soil fairly open, and the tilth fine, firm, and free from weeds.

Manuring.—Sorghum is a vigorous grower, and will generally pay for liberal manuring. About 10 tons of dung per acre should be applied in autumn, or early winter, and the following artificials shortly before the seed is sown:—

2–4 cwt. superphosphate, and
¾ cwt. sulphate of ammonia or 1 cwt. nitrate of soda } per acre.

If dung is not available the artificials should be increased.

Time and Method of Sowing.—The seed should not be sown until the soil is thoroughly warm, in spring, and risk of the plant being damaged by frost is past: from the middle to the end of May is usually the most suitable time. The seed may be sown broadcast, or in rows, the former only if the land is thoroughly clean. Sown broadcast, or in narrow rows about 7 in. apart, the plant grows tall with thin stems, and produces an abundance of leaves. If the whole crop is not utilised for feeding green, the surplus may be made into hay, if the weather is favourable, or converted into silage. In 1914 a crop of *Sorghum vulgare*, grown as described, reached a height of 7 ft. in Essex, and produced over 20 tons of green forage per acre. In a suitable season an excellent supply of succulent green fodder might be obtained by the end of July, but the maximum yield is not reached till about the middle of August.

The quantity of seed required will vary according to the method of sowing, and the character of the tilth. When drilled in rows, 7 in. apart, 20 lb. per acre should be ample.

As different stocks are on the market, Sorghum seed, preferably American grown, should be obtained from a reliable seedsman.

Utilisation.—The crop is usually cut green, as already indicated, and fed in the same way as maize. It is specially valuable for feeding to dairy cows in late summer when the pastures begin to fail. Although not quite so productive as maize, it possesses at least two advantages over that crop; it is ready for cutting a week or two earlier, and the cost of the seed is less. The normal price of Sorghum seed is about 3*d.* per lb. (at present it costs from 3*d.* to 5*d.*, so that an acre may be sown at a cost of from 5*s.* to 8*s.* 4*d.*) White Horse Tooth Maize, on the other hand, which is usually sown at the rate of 2 bushels per acre, is quoted in seedsmens' catalogues at from 9*s.* to 12*s.* 6*d.* a bushel—or 18*s.* to 25*s.* per acre.

Although, so far as the Board are aware, no harmful effects have followed the feeding of Sorghum in this country, it is well to indicate that in hot countries green Sorghum has been known to produce injurious and even fatal results. In America it is considered dangerous to feed second-growth Sorghum, but the first cut is generally regarded as quite safe.

It is worthy of note that where Sorghum and maize will grow well, they will probably yield at least as much dry matter per acre as an average root crop grown under the same conditions, at much less cost, and in a shorter time. An additional advantage is that the shade they give has the effect of suppressing weeds.

Mussels as Manure.

An enquiry made by the Board in 1914 elicited the fact that very little use is made in England of mussels as manure, Kent and Essex being the only two counties in which they are purchased to any appreciable extent by farmers for this purpose. Analyses which were forwarded to the Board in some instances show, however, that mussels would have a certain manurial value; the whole mussel (shell and contents) would seem to contain from 0·7 to 1·0 per cent. of nitrogen; 0·14 to 0·54 per cent. of phosphate; and from 0·09 to 0·13 per cent. of potash. On the basis of these figures mussels might have an average value for manurial purposes of about 12*s.* a ton.

Besides the substances mentioned mussels contain considerable quantities of carbonate of lime (the shells consist almost wholly of this substance). It would take some time

for the shells to break up (they would probably not decompose until at the earliest in the year following application) and for the carbonate of lime to be of any use in the soil. Further, nearly all the nitrogen is contained in the "fish," and hence the mussels should be crushed and dug in. If they were simply spread over the land, the contents would decay inside the shells, and as the fish would not come in contact with the soil until the shells were dissolved much of the nitrogen might escape as ammonia without being absorbed, and the mussels might therefore have very little value. From this point of view, as well as from the desirability of rendering the carbonate of lime more quickly available, grinding would be an advantage.

Mussels have been used as a manure for many crops in Kent, but especially for mangolds and other roots, potatoes, cabbage, cauliflower and celery. The lime and organic matter present would be useful on light soils, while an improvement in the working of heavy soils as a result of the use of mussels is reported in Essex.

The price of mussels in Essex seems to be 20*s.* per 100 bushels out of boats alongside, 150-200 bushels per acre being used. In Kent the cost is 8*s.* to 9*s.* per ton ex wharf at Faversham; and Whitstable mussels are sold at 15*s.* per ton to any Kent railway station within reasonable distance.

It must be pointed out that the use of fresh mussels as manure seems a wasteful proceeding, as it means the dissipation of the energy stored in the conversion of inorganic into organic substances; it might be profitable to dry the mussels and make them into a feeding meal as in the case of other fish and fish offal.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

The Effect of Straw on the Utilisation of Organic Manurial Nitrogen (*Mitt. der Landw. Lehrkanzeln der K.K. Hochschule für Bodenkultur in Wien*, Bd. II., Heft 3, 1914).—As a result of experiments carried out at the Imperial High School for Soil Culture at Vienna the conclusion is reached that the utilisation of organic manurial nitrogen (*e.g.*, the nitrogen in dung) by plants grown immediately after manuring is adversely affected by the addition of a non-nitrogenous organic substance—in this instance straw—and that the extent to which this is

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

the case depends upon the ratio between the straw and the available nitrogen in the dung and soil. The greater the proportion of straw the greater is the adverse effect, and (other things being equal) those plants which satisfy their need for nitrogen in a short time suffer most. The withdrawal of soluble nitrogen by micro-organisms of the soil which use the straw as a source of energy is indicated as the cause of this phenomenon.

Storage and Application of Farmyard Manure (*Fühlings Landw. Zeitung*, 1st March, 1914; *Dr. F. Löhnis and J. Hunter Smith, B.Sc.*).—One of the greatest of agricultural problems is to utilise as fully as possible the plant nutrients in farmyard manure and to lessen the loss of nitrogen. It is considered that a solution of the problem may be found in the separate collection and storage of the dung and urine. The difficulty of collecting and storing large quantities of urine is obviated by the use of peat moss litter and this lessens the loss of nitrogen as ammonia.

The separate utilisation of the dung and straw mixture on the one hand and of the urine (with or without peat moss) on the other would appear to be rational not only because the loss is lessened, but because the two manures are so essentially different in their effects.

Thus the mixture of dung and straw depends for its value chiefly on its high bacterial content and its richness in humus-forming organic substances; its manurial effect is small—in the first few years and under the most favourable conditions the utilisation of the nitrogen is only 20 per cent. About half the nitrogen in dung is in the form of living and dead bacteria, and the other half in the form of undigested food constituents; a quick mineralisation of both parts is, therefore, out of the question; further, the plant nutrients in straw can only be very gradually broken down by the bacteria in the manure and the soil.

Urine, on the other hand, is relatively poor in bacteria and humus-forming substances, and rich in quickly available plant nutrients. Farmyard manure composed of a mixture of solid and liquid excreta often has a better effect in the first year than urine-free farmyard manure, but by the second year the advantage disappears, and the first year's advantage is often dearly obtained through the larger losses in storage and the incomplete utilisation of the plant nutrients in the urine. Used rationally (*i.e.*, separately) the nitrogen in the urine acts as rapidly as that in sulphate of ammonia or nitrate of soda.

Peat Moss Litter Manure (*Deut. Landw. Presse*, 20th February, 1915).—Owing to the shortage of nitrate of soda and sulphate of ammonia in Germany as a result of the demands made by the military authorities, top dressing with peat moss litter manure is being advocated. In the experiment detailed in this paper nearly as good results were obtained from peat moss litter manure as from nitrate of soda as top dressings for winter rye. It is usually recommended that the peat moss should be mixed with liquid manure by simple shovelling; this experimenter, however, advocates placing the peat moss at the bottom of the dung heap so as to absorb the constituents of the liquid manure washed down by the rain.

Partial Sterilisation of Soil by Antiseptics (*Jour. Agric. Sci.*, December, 1914; *W. Buddin, B.A.*).—A large number of such antiseptics as are easily volatile and removable from the soil were shown to produce true partial sterilisation of soil (see previous articles in this *Journal*), and were undoubtedly effective in increasing the productive capacity

of a soil under laboratory and pot culture house conditions, although they were unsuitable for application on the larger scale. Antiseptics which are not completely removable from the soil were, on the other hand, shown to have some lasting influence on the bacterial flora.

Experiments with Nitrogenous Manures (*Fühlings Landw. Zeitung*, 1st January, 1915.)—A scheme for testing various points in connection with manures has been carried out for several years at six German experiment stations.

With nitrate of soda there was found, in the aggregate, to be little difference whether the whole dressing was applied before sowing or whether half was so applied and half was given afterwards as a top dressing. Taking the yields of the crops when the manure was applied in one dressing as 100 the yields when the manure was applied in two dressings were as follows (of grain, tubers or roots, as the case may be): Rye 105, barley 103, oats, 102, potatoes 103, sugar beet 90. On the lighter soils it seems better to give the nitrate of soda in two dressings; on the heavier soils this has only proved profitable for barley and potatoes, a single dressing being more profitable for oats and sugar beet.

In comparing sulphate of ammonia and nitrate of soda as sources of nitrogen (equal amounts of nitrogen in the two cases) nitrate of soda proved superior in the great majority of cases. Representing the yields from nitrate of soda as 100 those from sulphate of ammonia were: Rye 93, barley 89, oats 97, sugar beet 95, potatoes 94, mangolds 68. Sulphate of ammonia, however, gave better results on a moor soil than nitrate of soda, and the yields from the former approached those of the latter more nearly on sandy than on loam soils. With rye, sulphate of ammonia gave better results when applied in spring than when given in autumn. The experiments bore out the general experience that autumn-sown cereals require very little nitrogen in autumn and that if not assimilated some of the nitrogen in both manures is washed out during the winter. Top dressing with sulphate of ammonia was not tried, as previous experiments had shown that inferior results had been obtained from using sulphate of ammonia in this way.

Calcium cyanamide proved much inferior to nitrate of soda and inferior also to sulphate of ammonia. Representing the yields from nitrate of soda as 100 those from calcium cyanamide were: Rye 74, wheat 87, barley 75, oats 79, sugar beet 66, potatoes 78, mangolds 72. Nitrate of lime was very similar in its action to calcium cyanamide. There were no noteworthy differences between the effect of calcium cyanamide on sandy and loam soils. The application of the manure in autumn was much less profitable than in the spring, and gave best results when applied very shortly before sowing (except with sugar beet). Inferior results were obtained from using the manure as a top dressing. With rye, sugar beet and potatoes, the superiority of nitrate of soda was increased with increased dressings of both manures.

The experiments showed that, on the average, 39 per cent. of the nitrogen given in the form of nitrate of soda was lost to the crop. Representing the utilisation of the nitrogen in nitrate of soda (*i.e.*, 61 per cent.) as 100 the utilisation of that in sulphate of ammonia and calcium cyanamide was 78 and 65 respectively. The nitrogenous manuring had very little effect (if any) on either the *percentage* content of the crop in nitrogen or the quality of the produce (starch content of grain and potatoes and sugar content of roots).

FIELD CROPS.

Varieties of Potatoes (*Northants C.C. First Ann. Rept. on Field Expts.*, 1914).—The total yields on a clay loam were (per acre) :—Arran Chief, 11 tons 8 cwt.; Up-to-Date, 10 tons 3 cwt.; International Gem, 9 tons 11 cwt.; King Edward, 9 tons, 10 cwt.; King George, 8 tons 19 cwt. The total yields on a medium loam were (per acre) :—Up-to-Date (Irish seed), 10 tons 4 cwt.; Arran Chief, 9 tons 6 cwt.; International Gem, 9 tons 4 cwt.; Abundance, 8 tons 13 cwt.; Up-to-Date (local seed), 8 tons 6 cwt.; King George, 7 tons 19 cwt.; King Edward, 7 tons 10 cwt. Except in the case of Up-to-Date (as indicated) the seed was obtained from either Scotland or Ireland. Arran Chief is a late or main crop potato, round in shape and having a strong upright haulm; it appears to be an excellent cooker.

Varieties of Potatoes (*East Anglian Inst. of Agric., Rept. on Field Expts.*, 1914).—In 1914 the land received dung and artificials; the seed was obtained from Perthshire and Montrose; the crops were lifted on the following dates :—Earlies July 30th, second earlies August 17th, and lates October 5th.

Amongst the earlies Duke of York, Eclipse and Epicure proved the most productive, Eclipse and Epicure having given very good yields during the past four seasons. The total yields in 1914 were as follows (per acre) :—Duke of York 8 tons 8½ cwt., Eclipse 8 tons 7¾ cwt., Epicure 8 tons ¾ cwt., Midlothian Early 7 tons 6½ cwt., Sharpe's Express 6 tons 2¼ cwt. Although as regards total yield Eclipse was slightly superior to Epicure, the latter produced a much larger proportion of saleable potatoes.

As regards second earlies British Queen was the heaviest cropper in the trials conducted in 1911, 1912 and 1913, and was only 5 cwt. per acre behind the heaviest cropper in 1914. Two new varieties, D5 and White's Seedling, gave satisfactory results. D5 and King George produced a large proportion of ware. The following were the total yields per acre in 1914 :—D5 12 tons 4 cwt., British Queen 11 tons 19 cwt., White's Seedling 11 tons 10½ cwt., King George V. 11 tons 1¼ cwt., King Edward VII. 10 tons 1½ cwt., Arran Early 9 tons 6½ cwt., Queen Alexandra 9 tons 4½ cwt.

The yields of late varieties per acre were as follows in 1914 :—Caledonian and Legaston Don 13 tons 6 cwt., Baronet 13 tons 3½ cwt., Ajax White 12 tons 17¾ cwt., Record 12 tons 15¼ cwt., Scottish Farmer 12 tons 14¼ cwt., Dalhousie 12 tons — cwt., Up-to-date (Perth) 12 tons 4¾ cwt., Ajax Red 12 tons 3 cwt., What's Wanted 11 tons 8½ cwt., Arran Chief 11 tons 4½ cwt., Northern Star 11 tons 1¾ cwt., Dalmeny Regent 11 tons 1 cwt., Kidd's Seedling 9 tons 18¼ cwt. Scottish Farmer produced a very high percentage of ware and the best sample of tubers.

Varieties of Potatoes (*Lincs. (Lindsey) C.C. Educ. Com., Bull. No. 2*, 1914–15).—Trials were carried out at the Midland Agricultural and Dairy College to test the cropping powers of a large number of potatoes. Of the early varieties Epicure gave the best results, followed by Ninety-fold and Midlothian Early. The leading varieties among the second earlies, given in order of yield, were Dalmeny Radium, British Queen, Craigie Early and Pioneer. Of the main crop varieties, excluding small and diseased potatoes, the highest yielders, in the order given, were King George V., Evergood, Queen Mary, Arran Chief, Ajax (white), Chapman, and Ajax (red). The variety Queen Mary produced practically equal amounts of ware and seed.

Particulars as to the other varieties tested are given in the bulletin, as well as the results of small-plot potato variety experiments carried out on four farms in the county.

The Action of Manures on Grassland (*Jour. Agric. Sci.*, December, 1914; *R. G. Stapledon, M.A.*).—The various types of grassland in this country are capable of being classified according to fairly definite botanical characteristics, and are associated with definite geological formations or topographical features. The writer defines a "type" as "a plant community consisting of fundamental and subsidiary species, and being such that the contribution of each fundamental species to the total flora tends to be close to an optimum figure and does not increase above a certain maximum or decrease below a certain minimum."

Great change in environment causes even the chief species either to advance beyond their maxima or to recede below their minima, so giving rise to a different type. The prevailing husbandry is an environmental factor, sheep grazing, cattle fattening, the periodic removal of hay and manuring being capable of altering the type.

The action of manures depends on—

(1) Factors which are always operative, *e.g.* (*a*) botanical composition of herbage (before manuring) in relation to the type of grassland prevailing; and (*b*) meteorological conditions.

(2) Indirect factors, *e.g.* (*a*) disturbance of prevailing equilibrium of species, awakening competitive interaction; (*b*) effect on physical, chemical and biological properties of soil, thus modifying the texture and water capacity of the soil and the availability of plant foods.

(3) Factors directly dependent on the chemical composition of the manures, *e.g.* (*a*) the individual appetites of the several species for the particular plant foods in the form they are added, and (*b*) the physiologically depressing effect particular manures may produce on the individual species.

Manuring for Mutton (*E. Suffolk County Educ. Com., Rept. on Field Expts., Circ.* 15, 1915).—There are two plots only; one is unmanured, the other received 10 cwt. of basic slag in 1904 and again in 1912. The gain in live weight of sheep grazing the slagged pasture over that of animals on the unslagged pasture from 1905 to 1914, when valued at 3¾*d.* per lb., has resulted in an average profit per acre per annum of 15*s.* 10*d.*

Manuring of Grassland (*Northants C.C., First Ann. Rept. on Field Expts.*, 1914).—Experiments in the manuring of grassland were commenced in 1914 at five centres in Northamptonshire on land typical of the very large areas of poor cold pastures, on clay land, which are found throughout the county. Mechanical and chemical analyses of the soil at each centre are given, together with the results of the first season's work. Superphosphate was usually more effective than slag, although slag did better than might have been expected considering that it was applied late and that the season was dry. The report itself should be referred to for the results in detail.

Manuring of Meadow Hay (*Jour. Dept. of Agric. and Tech. Instr. for Ireland*, January, 1915).—In the liquid manure test in 1914, carried out at 81 centres, the increased yields of hay per acre resulting from manuring were as follows:—16 tons dung, 15¾ cwt.; 16 tons liquid manure, 16 cwt.; 1 cwt. nitrate of soda, 2 cwt. superphosphate and 2 cwt. kainit, 15¼ cwt.

The experiment with artificials on peaty soils in 1914 showed the most profitable dressing to be 1 cwt. nitrate of soda, 2 cwt. superphosphate and 2 cwt. kainit, *i.e.*, the dressing of artificials recommended by the Department in ordinary cases.

Manuring for Hay (*East Anglian Inst. of Agric., Rept. on Field Expts.*, 1914).—The field used had been down to pasture for many years. The soil was a deep loam. Various combinations of manures were applied to ¼ acre plots on March 24th, the crop being cut on June 22nd. The manuring and yields of hay were as follows (per acre) :—

Manure.	Yield. tons cwt.
No manure	1 12
1½ cwt. nitrate of soda	2 6½
1½ „ „ „ and 5⅓ cwt. superphosphate	2 7
1½ „ „ „ and 5 cwt. basic slag ..	2 0
1½ „ sulphate of ammonia and 5⅓ cwt. superphosphate	2 4½

Manuring of Poor Meadow Land (*E. Suffolk County Educ. Com., Rept. on Field Expts., Circ.* 15, 1915).—These experiments were commenced in 1901 on a field of exceedingly poor clay land. The following table shows the scheme of manuring and the cost, the total weight of hay produced in 12 years, 1902-14 (the land was grazed in 1908), and the profit from the treatment (figures per acre); the hay is valued at 50*s.* per ton :—

Plot.	Treatment.	Cost of Treatment (13 years)	Weight of Hay (12 years)	Profit from Treatment (12 years).
		£ *s.* *d.*	cwt.	£ *s.* *d.*
1*a*	10 cwt. basic slag, 1901, 1907 and 1912	3 2 6	325	23 12 6
1*b*	As on 1*a* + 2 cwt. kainit, 1909 and 1912	3 11 6	326	23 7 3
2*a*	5 cwt. basic slag, 1901, 1904, 1907 and 1012; 2 cwt. kainit, 1909 and 1912	2 10 8	269	16 7 10
2*b*	As on 2*a* + 1 cwt. nitrate of soda, 1909 and 1912	3 9 6	282	17 1 0
3	7 cwt. super, 1901, 1904, 1907 and 1912	3 10 0	290	18 16 3
4	Unmanured	—	114	—
5	As on 3 + 3½ cwt. kainit, 1901, 1904, 1907 and 1912	5 1 6	316	20 3 [illegible]
6	As on 3 + 10 cwt. lime, 1901, 1904, 1907 and 1912	5 10 0	313	19 8 [illegible]
7	As on 3 + 71 lb. sul. am., 1901, 1904, 1907 and 1912	5 3 9	334	21 12 0
8	6 cwt. dissolved bones, 1901; 3½ cwt. bone meal, 1904, 1907 and 1912	5 0 2	279	13 18 [illegible]

The addition of kainit thus increased the profit on the superphosphate plots and decreased it on the basic slag plots, the probable explanation being that the soil contained sufficient potash, which was liberated by the lime in the basic slag on the plots where this latter manure was used.

Manuring of Clover *E. Suffolk County Educ. Com., Rept. on Field Expts., Circ.* 15, 1915).—In an experiment to test the effect of mineral manures upon clover the most profitable dressing proved to be 4 cwt. superphosphate and 1 cwt. muriate of potash per acre, the next best being 4 cwt. superphosphate alone. Dressings of basic slag, although profitable, were inferior to those of superphosphate, a fact perhaps accounted for by the dry season of 1914.

LIVE STOCK, FEEDING AND DAIRYING.

Calf Feeding (*Rept. on Field Expts. at Harper Adams Agric. Coll.*, 1914).—Sixteen shorthorn calves were fed for a preliminary period on new milk and then divided into four lots to test different methods of feeding. In Lot 1 each calf received 6 quarts of new milk daily throughout the experiment (10 weeks) and no other food. With Lot 2 the new milk was gradually reduced and a gruel substituted containing 2 parts oatmeal, 1 part ground linseed and 2 parts maize meal, and costing 12*s.* 8*d.* per cwt.; at the beginning the calves each received (per day) 4 quarts new milk and 2 quarts gruel made from ½ lb. of the meal, and at the end 3 quarts new milk and 3 quarts gruel made from ¾ lb. of the meal. With Lot 3 the gruel used with Lot 2 was replaced by one containing 5 parts ground linseed, 14 parts linseed cake meal, 2 parts flour and 2 parts locust bean meal, and costing 11*s.* 6*d.* per cwt.; at the beginning the calves each received (per day) 4 quarts new milk and 2 quarts gruel made from ½ lb. of the meal, and at the end 2 quarts new milk and 4 quarts gruel made from 1 lb. of the meal. The calves in Lot 4 received per head per day 6 quarts of separated milk, and at the commencement 2 oz. cod liver oil and ½ lb. crushed oats, the quantities of the two latter foods being increased eventually to 3 oz. and 1 lb. respectively.

The results of the experiment were as follows:—

	Lot 1.	Lot 2.	Lot 3.	Lot 4.
	lb.	lb.	lb.	lb.
Weight at start (4 calves) ..	638	938	634	632
Increase in weight in the 10 weeks.	458	284	346	407
Cost of this increase (food only)	£14	£9 11*s.*	£7 14*s.*	£4 15*s.*
Cost per lb. increase	7·25*d.*	8·06*d.*	5·34*d.*	2·80*d.*
Weight 14 weeks after experiment terminated	lb. 1,475	lb. 1,258	lb. 1,424	lb. 1,422

Mouldiness in Butter (*Jour. Agric. Research*, January, 1915).—In this paper mouldiness in butter is considered from the biological standpoint. The main points of practical interest brought out are that excess of curd favours growth of mould; that well-washed butter is less subject to mould; that butter from which water of buttermilk exudes and collects in the wrappings or container furnishes the best conditions for the beginning of the growth of mould, mould colonies possibly spreading from these wet areas to the butter itself; that wet surfaces, wet wrappings or high humidity are essential to the growth of mould in butter; and that salt up to 2·5 or 3 per cent. in butter is sufficient to eliminate mould or reduce it to negligible amount (this being equivalent to the use of a 12 to 15 per cent. brine).

Fat Lambs from Welsh Crosses (*Rept. on Field Expts. at Harper Adams Agric. Coll.*, 1914).—Ewes of the Improved Welsh breed were divided into three flocks and mated with pure-bred Ryeland, Romney Marsh and Improved Welsh rams. The lambs were dropped in February and March, all appearing hardy and strong; and all ewes and lambs were fattened together and sold from May to August. The following were the results:—

——	Rycland.	Romney Marsh.	Welsh.
No. of ewes lambed	18	18	18
Lambs dropped	32	28	26
Average No. of lambs per ewe ..	1·7	1·5	1·4
Live weight when sold	80 lb.	84 lb.	75 lb.
Average price realised for lambs	35*s.* 9*d.*	35*s.* 3*d.*	34*s.* 7*d.*
Total for lambs	£57 4*s.*	£49 7*s.*	£44 19*s.*
Average per ewe by sale of lambs	£3 3*s.* 6*d.*	£2 14*s.* 10*d.*	£2 9*s.* 11*d.*

The Fattening of Unprofitable Dairy Cows (*Jour. S.E. Agric. College, Wye*, 1913, ; *C. Hutchinson, B.Sc.*).—This experiment was designed to obtain further information as to the advisability of substituting a fattening ration for the normal milk production ration in the case of barren cows, with the view of fattening them for slaughter when they dry off. Five Shorthorn cows were utilised; they were in healthy milking condition, and typical of the drafts which occurred year by year in a herd of 25 cows.

The test was divided into 3 periods. During the first period, from 24th October to 19th December, each cow received on the average a maintenance ration of 40 lb. swedes or mangolds, 7 lb. meadow hay 14 lb. oat straw, 2 lb. Egyptian cotton cake, and 1 lb. molascuit per day, and as a milk-producing ration each animal was given 4 lb. of a mixture of equal parts of Egyptian cotton cake, crushed oats, gluten feed and bran daily for each gallon of milk she produced. The financial results of the first period were as follows:—Value of 3,852 lb. of milk, £12 16*s.* 9½*d.* value of 122 lb. live weight increase, £2 5*s.*, less cost of maintenance ration, £9 18*s.* 4*d.*, and of milk-production ration, £4 2*s.* 6*d.*, giving a profit over the cost of food of £1 0*s.* 11½*d.* for all the cows.

Throughout the second period, from 19th December to 13th February the cows were confined to stalls and received, in addition to the food previously allowed, a fattening ration of 6 lb. each per day of a mixture of 2 parts linseed cake and 1 part each of Egyptian cotton cake, dried grains and gluten feed. The returns of the second period were:—Value of 3,807 lb. of milk, £12 13*s.* 9½*d.*, value of 454 lb. live weight increase, £8 7*s.* 6½*d.*; less cost of maintenance ration, £9 18*s.* 4*d.*, milk-production ration, £4 1*s.* 7*d.*, and fattening ration £5 15*s.* The excess of the returns over the cost of food was thus £1 6*s.* 5*d.*

During the third period, from 13th February until each cow was sold, the average duration being seven weeks, the milk-production ration was discontinued, and 4 lb. per head per day of para rubber seed cake were added to the fattening ration. The cows were dried off as quickly as possible and sold when sufficiently fat. The results for the third period were:—Value of 895 lb. of milk, £2 19*s.* 8*d.*, value of 357 lb. increase in live weight, £6 11*s.* 9*d.*; cost of maintenance ration, £8 11*s.* 5*d.* and cost of fattening ration £8 8*s.* 6*d.* The cost of the food thus exceeded the returns by £7 8*s.* 6*d.*

No attempt was made to take into consideration the residual manurial value of the food consumed or to include expenses other than the cost of food. From the results obtained, however, it was concluded that the milk yield of a barren cow should not be allowed to reach an unprofitable level before a fattening ration is allowed. The introduction of such a ration to a cow in milk and already suitably fed will arrest

the normal decline in milk yield, and produce a considerable live weight increase. The results of the third period suggested that the interval between drying off and sale should be made as short as possible.

DISEASES OF ANIMALS.

Bacillary Necrosis of the Liver in Unborn Lambs (*Jour. S.E. Agric. Coll., Wye*, 1913; *T. W. Cave, F.R.C.V.S.*).—In March, 1913, the College received a report from a sheep owner that his ewes were dropping a large proportion of still-born lambs. Ten dead lambs were received and examined at the College, and eight were found to have "spotted" livers. In all the eight cases the same diseased areas were found in the liver.

A microscopical examination of the diseased areas was made and the presence of the bacillus of necrosis was determined. A culture was prepared, and a rabbit was inoculated. In ten days extensive necrosis of the skin was seen, and on killing the animal the disease was found to have extended through the muscles of the abdominal wall at the groin down to the peritoneum.

It was concluded that the loss of about 100 lambs, mostly still-born, was due to bacillary necrosis of the liver, but no evidence could be obtained as to the origin of the disease, though it appeared that in most cases the disease must have existed for some considerable time before birth. It was, unfortunately, impossible to test the presence and nature of the disease in the ewes, but it is hoped that further investigations may be made should the disease reappear.

WEEDS.

The Identification of the Country of Origin of Commercial Samples of Oats (*Roy. Agric. Coll., Scientific Bull. Nos. 4 and 5; C. B. Saunders*).—Considerable quantities of oats are imported into England for feeding purposes, and, while many are of excellent quality, such oats are sometimes sold as, or admixed with, English oats, and it is somewhat difficult for the inexperienced buyer to detect the substitution.

In this investigation a detailed examination was made of the weed impurities in samples of the 1912 crop of oats from Argentina, Germany, Russia, Canada and the United States, and the results were classified. The results show that it is possible to state, with reasonable accuracy, the district from which a given sample may have originated.

On an average Russian oats were found to contain the largest quantity and the greatest variety of impurity, some samples containing nearly 5 per cent., by weight, of weed seeds and dirt. Argentine oats were next in order, followed by those from Germany, Canada and the United States. Apart from impurities, the best feeding samples were Canadian and German oats; Russian oats were very variable, while American and Argentine oats were usually thin, husky and of low bushel weight.

Russia.—There did not appear to be any very great difference between the weed impurities of the north and south Russian oats, about 50 to 60 species being found. The most characteristic features were the abundance of *Lychnis Githago* and species of vetch, especially *V. sativa* and *V. angustifolia*; the usual occurrence of *Panicum miliaceum, Setaria glauca, Galeopsis tetrahit* and *Convolvulus arvensis*; the frequent occurrence of *Euphorbia* sp., *Neslia paniculata, Scleranthus annuus*, and *Raphanus* and *Melilotus*.

Germany.—Oats from the north-east of Germany exhibited practically the same impurities as Russian oats, but were generally better cleaned; in samples from north-central Germany *Raphanus* and *Centaurea cyanus* were especially abundant; whilst in south German oats *Centaurea* was uncommon and *Galium* frequent. Considering all German samples together, the weeds usually present in large numbers were *Polygonum Convolvulus, Raphanus Raphanistrum* and *Centaurea cyanus*; those usually present in small quantities were *Vicia hirsuta, V. angustifolia, Brassica arvensis, Polygonum lapathifolium, Vicia sativa* and *Lychnis Githago*; those present in many cases were *Ornithopus sativus, Spergula arvensis, Galeopsis tetrahit* and *Galium aparine.*

Canada.—The weeds usually present in large quantities were *Polygonum convolvulus* and *Chenopodium* sp.; those usually present in small quantities were *Neslia paniculata, Linum usitatissimum* and *Lappula echinata*; those present in many cases were *Thlaspi arvense, Brassica* spp., and *Camelina sativa.* The characteristic features of the weed impurities in Canadian oats appear to be the usual occurrence of *Neslia paniculata* and *Lappula echinata,* and the frequent occurrence of *Thlaspi arvense* and *Camelina sativa.*

United States.—American oats naturally exhibited impurities somewhat similar to Canadians. The principal differences were the more frequent occurrence of *Setaria glauca* and, to a less extent, of *Rosa pratincola,* and the larger quantities of seed of *Brassica* spp. present. The weeds usually present in large quantities were *Brassica* spp.; those usually present in small quantities, *Polygonum Convolvulus, Setaria glauca* and *Chenopodium* spp.; those present in many cases, *Rosa pratincola, Setaria viridis, Polygonum Persicaria.*

Argentina.—Apart from very dirty samples of Russian oats, Argentine samples were more readily identified by their weed seed contents than any other. The species of diagnostic importance were *Anthemis Cotula, Lolium temulentum,* and, more particularly, *Silybum marianum* and a species of *Phalaris*; in addition, the amount of *Avena fatua* and *Melilotus* was larger than in other samples, and *Centaurea solstitialis* was not infrequently found, whereas it was not identified in any other cases. The weeds usually present in large quantities were *Melilotus alba, Brassica campestris* and *Avena fatua*; those usually present in small quantities, *Anthemis Cotula, Lolium temulentum, Polygonum Convolvulus, Phalaris* sp., *Lychnis Githago* and *Silybum marianum*; those present in many cases, *Linum usitatissimum, Medicago lupulina, Raphanus Raphanistrum, Stellaria media,* an *Umbellifer* and *Lithospermum arvense.*

HORTICULTURE.

Cider Sickness (*Jour. Bath and West Soc.*, 1914–15; *B. T. P. Barker, M.A.*).—Experiments carried out at the National Fruit and Cider Institute showed that cider sickness may be prevented (1) by mixing the sick cider with a sharp cider in such proportion that the acidity of the mixture is at least ·5 per cent., (2) by adding tartaric acid at the rate of about 2 to 4 lb. per 100 gal., (3) by adding thick brewers' yeast (which has been well washed) in the proportion of 1 part to 120 by volume.

On the other hand, aeration and the addition of sulphur-dioxide gas were of no use in remedying sickness.

Brewers' yeast has the disadvantage that it reduces the sweetness of the cider and it cannot be used if it is desired to keep the cider at the original high gravity, because, to ensure a good result, it is necessary to ferment the cider 10 to 15 points down, thus changing it from a sweet cider to a drier one. Pressed German yeast, in the proportion of about 2 lb. per 100 gal. of cider, can be used in the place of brewers' yeast.

Sweetening of Cider (*Jour. Bath and West Soc.*, 1914–15; *B. T. P. Barker, M.A.*).—Results were obtained somewhat contrary to previously accepted views in this country as to the relative merits of cane sugar and beet sugar for sweetening cider. Most of the samples of cider sweetened with cane sugar did not keep, but were attacked by a bacterial disease, whereas all the beet sugar samples remained in good condition. But, apart from this, the flavour of the cane sugar samples was inferior in all cases (except where the respective raw sugars were compared, when there was no difference), the peculiar flavour of the cane sugar being easily detected, while the beet sugar gave no new flavour to the cider.

Blackening of Cider (*Jour. Bath and West Soc.*, 1914–15; *B. T. P. Barker, M.A.*).—It is sometimes the case that cider which has been kept in bottles or casks, when poured out into a glass or otherwise exposed to the action of the air, changes colour in a short time, assuming a greenish-black tinge.

This investigation proved iron to be the cause of the abnormal colouring, iron getting into the juice from the iron mill, iron shovels, and other appliances of iron used in the making; it is also possible that soil adhering to the apples in some cases brings iron into the juice.

It is consequently essential to use iron appliances only when strictly necessary, and to clean them well before and after use. It is especially important that the juice and particles of pomace be removed when milling is finished for the day, because otherwise the acid from the fruit mill dissolves some iron which will get into the juice prepared the following day.

POULTRY.

Bacterial Content of Various Kinds of Eggs (*U.S. Dept. of Agric., Bull.* 51).—Experiments have shown that fresh eggs contain few bacteria or moulds and that evidences of bacterial decomposition in eggs cannot be recognised by sight and smell until the organisms have increased enormously in the food substance. This enquiry dealt with the extent to which changes due to temperature, humidity, odours, etc., are reflected in the composition of the egg, together with their recognition by physical, chemical and bacteriological methods. Individual eggs were examined bacteriologically in the laboratory and composite samples were tested chemically and bacteriologically in the packing house.

Laboratory Examination.—The great proportion of second-grade food eggs examined, medium stale eggs, hatch-spot eggs, heavy "rollers," dirty eggs, cracked eggs, and eggs with yolk partially mixed with albumen, contained less than 1,000 bacteria per gramme. The occasional high bacterial content of single cracked eggs, dirty eggs, etc., could in most instances be predicted by the appearance of the shell or by the odour and condition of the contents. *B. coli* was not present in the whole-shelled second-grade eggs and was present in only 5·9 per cent. of the cracked-shelled eggs. It was shown that 26·5 per cent. of

the eggs with adherent yolks, 50 per cent. of the eggs with dead embryos 75·9 per cent. of the mouldy eggs, 66·7 per cent. of the " white rots," and 100 per cent. of the " black rots " contained over 1,000 organisms per gramme. With the exception of the white rots and black rots, *B. coli* was present in but few of the eggs.

Packing House Examination.—July and August first-grade eggs contained very few organisms, and in many cases no bacteria of the *B. coli* group.

The majority of the samples of clean-shelled second-grade eggs had a comparatively low bacterial content, only 8·3 per cent. of them containing over 1,000,000 organisms per gramme. The number of *B. coli* varied in the different specimens from 0 to 100,000 per gramme.

The percentage of bacterial counts over 1,000,000 per gramme in dirty eggs, eggs with cracked shell but intact membrane, and eggs with yolk partially mixed with albumen was 16·6, 18·8 and 20 per cent. respectively. No greater number of *B. coli* was found in these samples than in samples of second-grade eggs.

The samples of blood rings contained comparatively few organisms. The large blood rings in most instances showed more infection than did the small rings. Most of the specimens contained less than 10 *B. coli* per gramme.

The amount of protein decomposition, as shown by the ammoniacal nitrogen in the preceding types of eggs, was greater, as would be expected, than that found in strictly fresh eggs, but was no greater than that found in some grocery eggs. Although a cracked or dirty shell may be a factor in facilitating infection and subsequent decomposition, the data obtained show that cracked eggs with intact membranes, and dirty eggs, are as well preserved as the clean whole-shelled second-grade eggs or the July and August first-grade eggs.

The majority of the samples of " white rots," eggs with yolk lightly adherent to the shell, and all of the samples of sour eggs, " black rots," eggs with a green albumen and eggs with yolk heavily adherent to the shell, were infected with bacteria. *B. coli* was present in most of these samples, forming the predominating organism in the samples of sour eggs.

The eggs with yolk lightly adherent to the shell were, chemically, slightly lower in quality than were second-grade food eggs, whereas the sour eggs, " white rots," eggs with a green white, and eggs with yolk heavily adherent to the shell, showed much more deterioration. " Black rots " had five times as much ammoniacal nitrogen as any of these types of eggs.

MISCELLANEOUS.

Town Smoke and Plant Growth (*Jour. Agric. Sci.*, December, 1914; *C. Crowther, M.A., Ph.D., A. G. Ruston, B.A., B.Sc.*, and *D. W. Stewart, B.Sc.*).—Previous studies by these investigators had shown that the effect of smoke on plant growth is (1) to reduce the available solar energy, (2) to reduce the assimilatory powers of the plant leaves, and (3) to cause corrosion of the leaf tissue as a result of the presence of free acid in the air, this latter also causing indirect damage by way of the soil where the latter is poor in calcium carbonate.

Box experiments were carried out with soil from Garforth at each of six experimental stations in and near Leeds; the crops tested were radishes, lettuces, cabbages and wallflowers. Apart from a few slight irregularities the results indicated a fairly close correlation between

the relative degree of purity of the atmosphere and the actual amount of plant growth obtainable; further, evidence was obtained that the effects of the smoke were cumulative, the results at the most badly polluted centre becoming, in comparison, worse with each succeeding crop. As regards the injurious effects on the soil, analyses of samples of soil showed that it was a question of the inhibition of the activities of the nitrogen-adapting bacteria as well as the steady depletion of the stock of calcium carbonate.

Further box experiments were carried out with perennial rye-grass and buckwheat, but the results here do not seem to have been so conclusive as the foregoing.

The effects in detail of smoke on trees, grasses and cereals (plants and grain) are described.

The "Feuillette" Flax-Retting Process (*Annales de l'Institut National Agronomique*, 1914).—The decline in flax production in France is attributed, partly to the competition with cotton, and partly to the inferiority of the processes for converting the raw material into fibre (*i.e.*, retting and scutching). Numerous attempts at retting by chemical means have proved unsuccessful, and large quantities of French flax have ordinarily to be taken to the Lys valley (N.E. France and Belgium) to be retted.

This publication describes a bacteriological process invented by M. Feuillette and recently tested by the French Machine Testing Station with excellent results. The process is as follows: After beating, the flax is tied into bundles, each consisting of four handfuls placed top against bottom so that the bundles are cylindrical. The bundles are then placed vertically in large wooden crates which are kept immersed in a trough; a small flow of lukewarm water is kept running into the retting trough, which may be of wood, stone, cement, etc.; the water in the trough is thus kept at about 25° C., the temperature which is recognised as being most favourable to the development of the retting bacteria. The process of retting develops a certain heat which contributes to the maintenance of this temperature, but at times it is necessary to run warm water or steam into the trough to maintain the temperature. The regular flow of warm water into the trough ensures the constant renewal of the water, a fact which is of importance as retting in stagnant water yields an inferior product; on the other hand, too strong a flow of water carries away some of the bacteria and thus weakens the bacterial action. The warm water is run into the bottom of the trough, and the water is run off at a higher level where the bacterial culture is most concentrated.

The crates filled with the bundles are kept immersed by a mechanical contrivance. The crates are taken out every day and reversed in the trough so that the bundles at the end of the process have been allowed to steep for an equal length of time each way; this is necessary to secure uniformity, as retting proceeds more quickly at the top of the trough than at the bottom; the retting bacteria are, further, aerobic, and this process has the effect of aerating the flax, while the bacteria of putrefaction and other harmful bacteria are prevented from multiplying.

The artificial retter has the advantage over the Lys retters, in that the different operations are under better control and the process is thus more sure and rapid. The crates in which retting is finished are taken out every day and the others are moved along in the trough. Fresh crates are placed at the end farthest from the inflow of water, *i.e.*,

where the bacterial culture is most concentrated, and moved along into less concentrated culture in accordance with the extent to which retting has proceeded, the flax stem being more sensible to the action of bacteria as retting proceeds.

After removal from the trough the flax is put into a washing and drying machine. This machine consists of a horizontal wheel divided into radial compartments in which the flax stems are placed, radially from the centre of the wheel, which is then set going slowly. A flow of water from the centre outwards removes the excess of gummy matter and all impurities from the stems. The water is then stopped and the machine turned quickly for drying, the water escaping through holes in the rim of the wheel. Drying is completed by placing the flax on a kind of hurdle on small waggons passed down a long passage ventilated with warm dry air. Drying is thus very safe compared with the operation as conducted in the open fields near the banks of the Lys.

Specifications of the machinery are given, together with a complete account of the trials at the Machine Testing Station. As Seine water was used with good results, the writer does not think that the water of the Lys has any bacterial properties more favourable to retting than water from elsewhere, and he ascribes the success of the Belgian retters to the rate at which the Lys water flows.

NOTES ON AGRICULTURAL CO-OPERATION.

An Italian Co-operative Cattle Insurance Society.

THERE are in Italy 812 societies for the mutual insurance of cattle, and it is instructive to study the working and history of one of them, which was founded in 1907 at Ferentino in the Province of Rome. Ferentino is a country town of considerable size, perched on the top of a hill some 50 miles south of Rome, amid picturesque mountainous scenery. The surrounding land is fairly fertile and well cultivated, the principal crops being vines, olives and wheat.

The agricultural holdings are generally small in area, and many are owned by the holders themselves. There are few outlying farm-buildings, and as most of the cultivators live in the town itself, they have often to go several miles to and from their fields, which must involve a considerable waste of time and make manuring operations difficult. Practically all the farm-work is done with bullocks, and seeing how much the loss of a cow or bullock may seriously embarrass a small farmer, a number of the more intelligent land-owners, at the instance of one of the itinerant lecturers on agriculture, with whom Italy is well provided, resolved to found a society for mutual insurance against losses from the death of cattle. The Society has been very successful, the number of members having risen steadily in the four years, 1910–13, from 122 to 336, almost all of whom are engaged in agriculture.

Constitution of the Society.—The ordinary membership of the Society is confined to owners of cattle residing within the *commune* (parish) of Ferentino, but cattle-owners residing in its immediate neighbourhood may also be admitted if the committee consider it possible to maintain without difficulty the necessary supervision over their cattle. In practice the Society's operations cover a circle of about three miles radius round the town. The entrance-fee, originally fixed at 1*s.* 8*d.*, has since been raised to 4*s.* per member. The Society holds a general

meeting half-yearly in February and August, but the ordinary management of its affairs is in the hands of a committee, consisting of a president, (at present the Mayor) a vice-president and five committee-men, elected from among the members, one of whom acts as treasurer. It has also a council of control, consisting of three members, which sees that the rules are carried out and the books properly kept, and has the power of calling a general meeting to deal with any irregularity it may notice, a secretary, and at least three inspectors, whose duty it is to visit and supervise the insured animals, especially those that fall sick. All these officials give their services gratuitously, although the rules allow of a salary being paid to the secretary.

Animals Insured, Compensation and Premiums.—The Society insures only horned cattle of not less than four months old, an insured animal being marked by fastening in its ear a stud bearing the Society's name and the animal's number as entered in the register, so as to make its identification easy. When a claim for compensation is established, the Society pays the owner four-fifths of the value at which the animal was insured, and receives any sum that may be obtained from the sale of the animal or its carcass. At first the rate of insurance contribution was fixed as follows on the value for insurance—

(1) For fattening, breeding and milch animals, 1½ per cent.

(2) For working bullocks, 2½ per cent.

After some experience however, the rates were revised and they now stand as follows :—

(1) Working bullocks, and breeding and milch cows—

Up to £20	2 1/6	per cent.
Over £20 and up to £30	3	,,

(2) Calves and fattening animals—

Up to £12	1½	,,
Over £12 and up to £18	2	,,

The maximum amount for which an animal can be insured is £30 for the first class and £18 for the second.

A bullock is generally set to work at two years old, but it is better not to break him in till he is two-and-a-half or three years old. In his prime at four years old, his average value is about £20. He can work till he is ten years old, but at about eight he is generally fattened for a few months and sold to the butcher, a good fat bullock fetching a price of about £24. A heifer is generally sent to the bull when she is eighteen or nineteen months old, and can go on bearing, perhaps eight calves, till she is ten years old, but before that she is generally fattened, and fetches a price of about £20 when sold fat.

The premium is paid in a lump sum in advance and the insurance takes effect from the 16th day after the date of the policy, and lasts till the end of the second half-year thereafter, the half-years ending for this purpose on the 30th June and 31st December. The policy can be renewed year by year, on notice given 20 days before its expiry.

The Society pays compensation in case of the death of an insured animal from disease or accident, but is not liable where the death of the animal is caused, first, by fire, fall of buildings, flood, war, invasion, riot, or by other forms of violence or crime : or second, by bad treatment or other fault of the member or of those to whom he entrusts the charge of the animal. It also refuses to pay any compensation when the member has given false information, declines to sell the sick animal when required by the committee, omits to inform the committee without delay when the animal falls ill or meets with an accident, or neglects

to use every endeavour to cure the animal in accordance with the suggestions of the committee.

A member who sells or exchanges an insured animal can substitute for it another insurable animal without additional payment. The committee are required, before accepting an animal for insurance, to have it inspected, and to make sure that it is sound and fairly valued. Insurance is refused when the animal shows symptoms of illness or is in distinctly poor condition, with due regard to its age, or when the owner neglects ordinary sanitary precautions in his treatment of the animal, more especially as regards the condition of the premises in which it is kept, or when the member has already insured the animal with another society.

When a case of anthrax or other contagious disease has occurred in the neighbourhood, the committee may suspend the acceptance of new animals for insurance up to 30 days after the last death from such a disease. The Society has the right to have inspections made of the premises on which the insured animals are kept, and the committee may suspend a member's right to compensation when it finds that he has committed a breach of the conditions of insurance or of elementary rules of sanitation. Whenever any accident happens to the insured animal or the member notices any symptom of illness, he must inform the committee and the inspectors within the succeeding 24 hours. The committee, on receiving such a notice, is required to satisfy itself that the policy has not expired and that there has been no fraudulent substitution of animals; and to decide whether the owner should be required to undertake the cure of the sick animal by adopting any suggestions made by the committee as to the measures to be taken, or to sell it at once; and whether the death, if it has already occurred, can be attributed to fraud or negligence on the part of the member, or to the other causes which exempt the Society from liability. The expenses of the feeding and the cure of the sick animal are at the charge of the member; but the Society may, when its finances allow, make a grant towards these expenses.

Extra Levies.—When during the year the available funds are exhausted, whether owing to extraordinary mortality or other causes, so that they are not sufficient for the payment of the claims, the committee may call upon the members to pay an extra levy not exceeding 7½ per cent. of the ordinary insurance contributions of the year. If this levy does not provide sufficient funds to meet all the liabilities of the Society, a general meeting must be summoned to decide, for the current year, on the adoption of one or both of the following measures: (1) the imposition of a further levy, (2) the reduction of the proportion of the insured value to be paid as compensation. The whole of the profits of each year must be carried to the reserve fund.

Recent Statistics with regard to the Working of the Society.—In 1913 the Society consisted of 336 members and issued 286 policies, covering 587 animals, valued for insurance at £10,552; so that on the average each insurer insures only two animals and the average value of an animal for insurance is £18. On the average of the four years 1910–13, the number of animals insured was 426, and the number of claims paid 18, so that the casualty rate averaged 4·2 per cent. per annum: it varied from 5·7 per cent. in one year to 3·1 per cent. in another. The average age of the animals on which claims were paid was for working bullocks 5¼ years, for cows 5 years, and for calves 12½ months. The amount paid in compensation averaged £209, or £11 12*s.* per anima

on which a claim was allowed, but nearly one-third of this sum was recovered by the sale of the animal or its carcass. When an insured animal dies or falls ill, or meets with an accident, and the committee, on the report of its inspectors, thinks it should be condemned as unfit for work or unlikely to recover, it is examined by a veterinary surgeon, who certifies the disease (if any) from which it is suffering and whether its flesh is fit for human food. If the disease is anthrax, the flesh and hide are destroyed; if pneumonia, tuberculosis or other dangerous disease, the flesh is destroyed and the hide sold; and if the disease is not considered to make the flesh unfit for consumption, for instance, if it is a disease of the limbs, or if the animal has been injured by an accident, it is either butchered or sold alive, the proceeds of the sale in every case being credited to the Society. Of the 72 animals on which claims were paid during the four years 1910–13, in 29 cases the flesh was destroyed, in 16 it was sold, and in 27 cases the animal was sold alive. The Society thus receives a considerable income from the sale of condemned animals, which goes to counterbalance to some extent the amount paid on claims. In the three years 1911–13, during which 55 claims were paid, the Society paid in compensation £683, but received for the sale of animals and carcasses £201, so that its net loss was only £482, an average of £8 15*s.* per animal on which compensation was paid. This is equivalent to an average annual net loss of 6*s.* 10*d.* per animal insured during those years. During the same three years the income from premiums amounted to £533, an average of 7*s.* 7*d.* per annum per animal insured; so that, taken by themselves, the income from premiums was more than sufficient to cover the net losses on claims.

The other income and expenditure of the Society are comparatively small, as no contribution is levied for management expenses, and as most of the work of administration is done without remuneration. In 1913 the Society had a windfall in the shape of a prize of £80 awarded it as being one of the best managed societies of the kind in Italy. The averages for the three years 1911–13 have been as follows:—

Average income.	£
Insurance premiums	178
Sale of condemned animals and carcasses	67
Prize from Board	27
Other income	5
Total income	277

Average expenditure.	£
Paid on claims	228
Salaries to clerk and marker	15
Other expenses	20
Total expenditure	263

Thus during these three years the average income exceeded the average expenditure by £14 per annum, and the reserve fund at the end of 1913 showed a credit balance of £34. Had the Society not received its £80 prize in 1913, its working would have resulted in a small net loss, and its balance sheet would have shown a deficit of £46. The working expenses averaged per annum £35, or 1*s.* 6*d.* per animal insured, and if the Society were to levy a separate management contribution of something like this amount it might expect to see its reserve fund increase satisfactorily, even if it did not again obtain outside help in the form of a prize. In England, when the costs of management are accounted for separately, a levy equivalent to 6*d.* per animal per annum is generally found sufficient.

It will be seen that the Society has adopted the principle of charging the insurance contribution at a higher percentage on the more valuable than on the less valuable animals. This would be fair only if the casualty rate were higher among the better animals than among those of less value; but, to judge from experience in this country and in India, among cattle owned by peasants, none of them so highly bred as to be delicate in constitution, the casualty rate among the more valuable cattle is likely to be less than among the less valuable, which are, on the whole, not so well cared for. Besides, this principle acts as a deterrent on the keeping of better-class animals, a practice which ought to be encouraged as much as possible. It would seem to be fairer and wiser therefore if the Society were to charge as premium the same percentage on all animals, whatever be their value.

Another principle adopted by the Society is to charge the same percentage on working bullocks as on breeding and milch cows, and a lower percentage on calves. To judge from the Society's own experience during the four years 1910-13, this also is unfair. Adding together the figures for those years, we have the following result:—

Class of Animal.	No. Insured.	No. of Claims paid.	Casualty rate per cent. per annum.
Working bullocks ..	522	15	2·9
Cows	552	30	5·4
Calves	628	27	4·3
All animals	1,702	72	4·2

Thus, as a matter of experience, the actual casualty rate among the working bullocks has been little more than half that among the cows. There is a further reason for charging a lower rate on the bullocks. What the Society has to meet in premiums is the net loss after deducting the receipts from sales of condemned animals from the amount paid in compensation, and on this point the following figures are instructive:—

Class of Animal.	Total No. on which Claims were paid.	How disposed of.		
		Sold alive.	Flesh sold.	Flesh destroyed.
Bullocks ..	15	5	3	7
Cows	30	6	9	15
Calves	27	16	4	7
All Animals ..	72	27	16	29

Thus the proportion of condemned animals which were sold alive, and therefore presumably brought a better price than they would have fetched if they had died or been slaughtered, was for bullocks, one third; for cows, only one-fifth; and for calves more than one-half. It seems that, although bullocks are more liable than cows to accidents, diseases

of the limbs, and injury to their health from exposure or over-work, the casualty rate among them is really considerably less than among cows, which are liable to many diseases and especially to those connected with parturition; for instance, during the four years, the number of deaths from anthrax alone was as follows: 2 bullocks, 8 cows and 1 calf. On the whole, it would seem that, to judge from the Society's own recent experience, a fairer system of charging premiums would be as follows:—

Working bullocks	2 per cent.
Cows	4 ,,
Calves	3 ,,

on the value at which the animal is insured, whatever that value may be. As the Society pays the owner as compensation only four-fifths of the insured value, these rates should leave sufficient margin to pay the expenses of management; but a better principle would be to charge say one franc (9½*d.*) per animal per annum as a management contribution and to keep the costs of management within that figure, leaving the surplus of the premium income to go to build up a reserve fund, which would protect the Society from the risk of having to make a levy in years of exceptional mortality, and would in time enable it to reduce the rate of premium charged to members of long standing.

Comparison with the Experience and Methods of English Cattle Insurance Societies.—It is interesting to compare the experience of this Italian Society with that of similar co-operative insurance societies in England and Wales. Most of the co-operative cattle insurance societies in this country insure only cows and female calves, and pay compensation in much the same class of cases as is done by the Ferentino Society. They do not however as a rule pay for any animal which can be sold alive; they make the owner do his best to cure the animal, and only pay compensation when it dies or has to be slaughtered as incurable. This may partly account for the higher casualty rate at Ferentino, which, for cows and calves taken together, is 4·8 per cent. per annum, while on the average of nearly 10,000 cows and calves co-operatively insured in this country, the casualty rate is only 2·6 per cent. Probably the main reason for this great difference in casualty experience, however, is that cattle in Italy are much more exposed to epidemic diseases than they are in this country, which has been enabled by its insular position and the general spread of veterinary and sanitary knowledge among the cattle-owning classes to reduce the risk of loss from such diseases to a minimum. Probably no English cow insurance society has, at all events for many years, had any loss comparable to the 11 cases of anthrax which have occured among the 426 cattle insured at Ferentino within the last four years.

Another marked difference is that at Ferentino the Society finds it possible to recover a considerable proportion of the amount paid as compensation by the sale of the condemned animals or of their carcasses, whereas in this country, owing no doubt to more stringent sanitary regulations and to a greater dislike to the consumption of meat suspected of disease, a condemned animal, unless its death was purely accidental, seldom fetches much more than the value of its hide. While the Ferentino Society during the three years 1911–13 paid £683 in claims, it recovered by the sale of the condemned animals and carcasses no less than £201, or nearly one-third of its losses; while in England, so far as our information goes, the proportion so recovered is less than one-tenth. Notwithstanding this advantage, the average annual net loss to the

Ferentino Society has been 6*s.* 10*d.* per animal insured, while in England the corresponding figure is about 4*s.* This difference is, however, partly accounted for by the fact that at Ferentino a member may insure his cow up to £30, in which case he would get from the Society £24 as compensation, while in England most societies fix a low maximum, such as £10 or £12, to the amount payable on the death of any animal: but as at Ferentino the average value for insurance of all the animals is only £18, it seems that most of the members are content with the lower maximum of £20 for a cow and £12 for a calf (four-fifths payable in case of death). At Ferentino, on a cow valued at not more than £20, the rate of premium charged is $2\frac{1}{10}$ per cent. on the value for insurance, and as only four-fifths of this value is payable as compensation, this is equivalent to 2·6 per cent. on the compensation payable; but, according to recent Ferentino experience, this rate is not nearly sufficient to cover the net losses in the case of cows, and should be raised to something like 4 per cent. On the other hand, in England, according to the experience of English cow insurance societies, a rate of a little over 2 per cent. on the maximum compensation payable is quite sufficient to cover the net losses among cows and provide for the building up of a reserve fund.

In England, it is not usual to insure fattening bullocks co-operatively, and there are few statistics available to show what is the death-rate from disease or accident among that class of animal, so that the Ferentino experience regarding casualties among working bullocks is interesting, and if the statistics could be extended so as to embrace the experience of a number of Italian societies they would be especially valuable in India and similar countries, where endeavours are being made to introduce a system of insuring working bullocks. At Ferentino the casualty rate among bullocks of this class has been only 2·9 per cent. as compared with 5·4 per cent. among the cows, and as the working bullock is kept to a greater age and exposed to much greater risks than the fattening bullock, it seems probable that an even greater difference in casualty rates exists between fattening bullocks and cows in this country; and that here, if, as experience proves, a little over 2 per cent. on the amount of compensation payable is enough to cover the net losses in the case of cows, then about $1\frac{1}{2}$ per cent. should be enough to charge in the case of fattening stock.

Although, to judge from its own recent experience, the rates of premium charged by the Ferentino Society require to be raised somewhat and readjusted in fairness to the working bullocks there can be no doubt that it has been most successful in insuring the cattle belonging to its members at small cost to them, and thus has saved many of them from what would, without it, have been ruinous losses.

OFFICIAL NOTICES AND CIRCULARS.

National Egg Collection for the Wounded.

IN order to meet the requirements of soldiers in our hospitals in France and at home, a supply of 300,000 eggs is needed each week. The National Egg Collection for the Wounded is at present securing a weekly supply of about 350,000 eggs, but the need for maintaining the figure at this high level is emphasised in a recent circular letter. Egg boxes are also urgently required, and poultry keepers who are willing to assist in providing these are invited to send their boxes, carriage forward, to the Central Depot, Messrs. Harrods, Ltd., Trevor Square, London, S.W.

Delay in Transport of Agricultural Machinery by Rail. Early Purchase of Binder Twine.

ON 15th April the Board of Agriculture and Fisheries gave notice that considerable delays are likely to arise under present conditions in the transport of agricultural machinery by rail, and the attention of farmers was directed to the desirability of making early arrangements for the purchases and repairs of such machinery so as to allow ample time for delivery.

In a further notice issued on 30th April, the Board suggested that farmers should purchase, at an early date, the supplies of binder twine they require, so as to allow ample time for delivery in this case also.

Rabies in an Imported Dog.

ON 17th April the Board of Agriculture and Fisheries notified that Rabies had been certified to have occurred in the case of an imported dog which sickened and died during the period of quarantine prescribed by the Importation of Dogs Order. This dog, which had been brought from Northern Nigeria, showed suspicious symptoms which led to bacteriological investigations being made by the Veterinary Officers of the Board into the cause of death, with the above-mentioned result. Owing to the fact that the conditions of the licence under which the dog was landed required detention and isolation on approved veterinary premises, the affected dog had no opportunity of coming in contact with any other dog in this country.

American Gooseberry Mildew.

THE Board of Agriculture and Fisheries have received information that the summer stage of American Gooseberry Mildew (*Sphærotheca Mors-uvæ*) was discovered in a Cambridgeshire garden on the 10th April. All gooseberry growers are advised to examine their bushes carefully, and should any sign of disease be found to spray their bushes with a solution of liver of sulphur (1 lb. to 32 gal. of water). A leaflet describing the disease and giving directions for dealing with it can be obtained from the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W., gratis and post free. Letters so addressed need not be stamped.

Growers are reminded that by Article 3 of the American Gooseberry Mildew Order of 1911 they are required to report the presence of this disease on their premises to the Board or the Clerk of the Local Authority for the district, either directly or through an Inspector, and that the failure to report is punishable by a fine.

Sheep Grazing on Golf Links.

IT has been suggested to the Board by Mr. H. S. Colt, the Acting Secretary of the Sunningdale Golf Club, that many of the golf links in this country might be more extensively employed at the present time for grazing sheep. Mr. Colt points out that, provided the animals are kept under proper control, no undue inconvenience would be caused to the players. The Board recognise that the grazing on a number of links is already used by farmers, but they think that there may still remain a considerable acreage which is not so utilised, and in view of the importance

at the present time of maintaining in the country as large a head of stock as possible, they would suggest that if any Golf Clubs have any land available for the purpose, they should communicate with the local Chamber of Agriculture or Farmers' Union, specifying the approximate acreage of the feed and the terms on which it would be available.

Harvest Weather Forecasts.

THE Meteorological Office will, as in past years, supply forecasts of weather by telegraph to persons desirous of receiving them, upon payment of a registration fee of 1s. and the cost of the telegrams, computed at 6*d.* per day. The supply of forecasts commenced on 1st May and will continue until 30th September. The forecasts are drawn up each week-day at 2.30 p.m. and refer to the probable weather during the 15 hours from 6.0 a.m. to 9.0 p.m. on the next day. Forecasts are also prepared at 9.30 a.m. and at 7.0 p.m. to cover the period of 24 hours commencing with noon or midnight next following their issue, and can be sent in lieu of the afternoon forecasts. The addition of a "further outlook" and the issue of notifications in connection with spells of settled weather will be suspended during the war.

Applications for the forecasts should be sent to the Director, Meteorological Office, South Kensington, London, S.W., with a cheque or postal order payable to the Meteorological Committee, to cover the cost of the telegrams for the period, which should not be less than 6 consecutive days, during which the forecasts are to be sent. The telegrams are estimated to consist of 16 words, exclusive of the address.

Agricultural Labour.

THE Agricultural Consultative Committee desire to bring to the notice of farmers the useful work which has been done by the Labour Exchanges in providing labour for various industries in connection with which a shortage was found to exist.

Although as a rule this agency has been neglected by agriculturists in the belief that applications addressed to the Exchanges would prove ineffective, upwards of six hundred labourers were supplied for farm work during March and April. All these were not skilled persons, but a number had some experience in milking or other farm work, while the remainder were capable of instruction and provided a means of meeting the deficiency caused by the absence of more skilled labour.

The failure of farmers to make use of this source of supply has given rise to the belief in some quarters that the alleged shortage of agricultural labour does not exist, and that complaints to that effect are due mainly to an unwillingness on the part of farmers to offer an adequate wage.

The Consultative Committee are pleased to think that the latter contention has been disproved by the fact that since the commencement of the war circumstances have in most districts justified an increase in farm wages averaging 15 per cent., in addition to the rise of from 5 to 10 per cent., which took place during the twelve months prior to the war; and they would suggest that if farmers needing labour would register their requirements with the Labour Exchanges, a double advantage would be secured. In the first place their doing so would afford the best possible evidence that the shortage of agricultural

labour was so real and acute that those suffering from it were unwilling to leave any possible source of supply untried; and in the second place, the Consultative Committee believe that were the demand for considerable numbers of men and women thus made clear, the Labour Exchange officials, who are in close touch with Irish and other sources of supply, might do much to find, at any rate, unskilled or partially skilled labour to meet farmers' requirements.

They would, therefore, strongly urge farmers to make known their needs to the Labour Exchanges, either individually or through the local Secretary of the Chamber of Agriculture or Farmers' Union.

The Provision of Labour for Agriculture.*

At the suggestion of the Board of Agriculture and Fisheries there are being established in a number of counties committees, representing the principal Farmers' Associations, for the purpose of dealing with any existing or anticipated shortage of agricultural labour. Many of these Committees have already met, and are taking steps to ascertain, as far as possible, the nature and extent of the shortage in their districts.

While the main demand for agricultural labour as indicated by the orders received at the Board of Trade Labour Exchanges is at present for skilled men—shepherds, cattlemen, ploughmen, &c., a supply of men of this type from normal sources must be treated as almost non-existent. Some townsmen who have had experience of farm work in their earlier years may possibly be available, but owing to the keen demand for men in town industries, only a small supply can be expected from this source. It is, therefore, important that farmers in need of labour should enquire at the Labour Exchanges with regard to the labour which is actually available and consider to what extent they can utilise such labour as a substitute for that which they employ in normal times. The Board of Agriculture and Fisheries desire to emphasise the fact that farmers must be prepared to use such labour as can be obtained although this may involve the use of types of labour to which they are not accustomed in normal times. The labour available belongs mainly to the following classes:—

(a) *Women.*—In some parts of the country, more particularly in Scotland and the North of England, a large proportion of farm work is accomplished by women. The Board of Agriculture and Fisheries are of opinion that during the present crisis it is desirable, if not indeed essential, that the practice of employing women for such branches of farm work as they are capable of doing should be extended. In addition to milking and dairy and poultry work, a large part of the work involved in attendance on cattle and pigs might be entrusted to them, while for potato planting, hoeing and many other branches of field work women would be quite suitable. Farmers would apparently be well advised to utilise as far as possible the labour of women living in the neighbourhood of their farms. Apart from this local source, however, it may be stated that, in connection with the Board of Trade's Scheme of War Service for Women, there were at the beginning of April some 4,000 women registered at the Labour Exchanges as willing to take up agricultural work. Of this number more than 1,500 have had previous experience of the particular type of work which they are now seeking. It may be added that a number of women are now being instructed in

* Statement issued by the Board of Trade.

dairy and light farm work (including milking and attendance on cattle, &c.) in a special demonstration course at various agricultural colleges and schools.

(*b*) *Irish Labourers.*—A considerable number of Irish labourers have already arrived in this country. It is, of course, impossible to make any definite statement in regard to the number who will come over later in the season, but there is apparently no reason to anticipate that the number which will come will be smaller than in previous years. Arrangements have been made through the Labour Exchanges to facilitate as far as possible the transference of these men to districts where there is employment for them. It must, however, not be expected that in districts other than those in which the employment of Irish labour is customary any considerable supply will be available from this source.

(*c*) *Partially Disabled Soldiers.*—A certain proportion of the men suffering from minor disablements and discharged from the Army as unfit for further military service will be available for farm work. Steps have been taken with a view to securing civil employment for these men as soon as they are fit for it. Many of them will have had some experience of farm work.

(*d*) *Boys.*—The Labour Exchanges are in touch with various authorities which have charge of boys, including the Industrial and Reformatory Schools, and a number of boys will be available for placing in situations on farms or market-gardens. The numbers from this source will, however, probably not be large.

Farmers can ascertain whether it is possible to meet their requirements from any of the above sources by informing the nearest Labour Exchange (of which the address may be obtained at the local Post Office) precisely what labour they need.

THE following statement is communicated to the Press by the Indian Wheat Committee, appointed by the Cabinet Committee on Food Supplies :—

The Export of Indian Wheat.

Arrangements for the regulation by the Government of the export trade in Indian wheat are now nearly completed. The necessity for such regulation has arisen out of the serious rise in the price of wheat in Northern India, in sympathy with the simultaneous rise in other parts of the world. As the price of wheat in India seldom falls below the price in London by appreciably more than the cost of moving the wheat to the United Kingdom, the price which can be obtained for the exportable surplus, although the proportion of this to the total crop fluctuates widely from year to year, governs the price of the wheat consumed in India herself, so long as export is taking place.

In the special circumstances of the violent rise in the world-price of wheat, the Government of India felt it to be against the interests of their wheat-consuming population to permit the continuance of unregulated export. In the absence of regulation there was a likelihood, in spite of expectations of an unusually bountiful harvest, of a level of prices in India scarcely precedented even in times of famine. The explanation of so great an anomaly as widespread distress in the midst of great and obvious plenty, would have been naturally sought in the existence and unregulated continuance of a competitive export trade.

The latest forecast of the crop, which is now being harvested in India, shows an area of 32,148,000 acres under wheat and an estimated yield of 10,293,000 tons, which is in excess of the previous record of

10,061,000 tons harvested in 1911, and compares with 27,697,000 acres and 8,427,000 tons last year. If this forecast is approximately fulfilled, there should be an exportable surplus from the present crop of at least 2,000,000 tons in excess of the normal Indian consumption. To prevent this surplus from finding a market would, on the one hand, have deprived India of a very valuable export in a year in which some of her other staple exports have been unfavourably affected, and have deprived her wheat cultivators of their legitimate expectations of profit, with the result of influencing adversely the area to be sown for wheat in future years; and, on the other hand, it would have deprived the United Kingdom of a source of supply on which, in the present circumstances, she is largely dependent.

The problem which presented itself, therefore, was to place it within the power of the Government of India to effect a divorce between the Indian and the world price of wheat (whenever the conditions of the wheat markets in India and elsewhere may render this advisable), without hindering the shipment to the United Kingdom of India's exportable surplus in such quantities and at such seasons of the year as might have been anticipated in the absence of regulation.

The policy, which has been adopted to this end, is as simple as the conditions of the problem permit. The Government of India have prohibited absolutely the export of wheat from India on private account for the whole period up to 31st March, 1916. The firms ordinarily engaged in the export of wheat from India, to whose willing co-operation and advice the Government are much indebted, have been appointed the agents of Government for the purpose of carrying on the trade under the orders and for the account of the Government of India. The maximum price to be offered by these firms to Indian sellers, instead of being regulated by the price ruling in London, will be determined from time to time by the Government of India and announced on their authority; and, as the season progresses, these maxima will be gradually reduced, so that there can be no inducement to speculate for a rise or to withhold supplies. The maximum price will be the maximum at the port, and firms must only offer up-country such prices as, with the addition of the railway charges, will not exceed this maximum. The necessary variations from the standard maximum will be fixed for the various recognised qualities of Indian wheat.

The working of the scheme in India will be supervised, subject to the orders of the Government of India, by Mr. M. M. S. Gubbay, Indian Civil Service. Supervision in London has been entrusted to the Indian Wheat Committee, which is constituted as follows:—

Lord Lucas (Chairman).
Mr. R. H. Rew (Board of Agriculture and Fisheries).
Mr. F. C. Drake (India Office).
Mr. J. M. Keynes (Treasury).
Mr. A. S. Gaye (Board of Agriculture and Fisheries).
Mr. E. G. Saltmarsh (The Baltic).
Secretary, Mr. H. D. Vigor, 3, St. James' Square.

For the chartering of freight the Indian Wheat Committee have secured the services as broker of Mr. Percy Glanville, of the firm of Messrs. Nelson, Donkin, and Company, who has set up a separate office at Exchange Chambers, St. Mary Axe, E.C., for the transaction of this business, and will devote the whole of his time to it. The firms which bought the wheat in India will sell it in the United Kingdom at market rates, on the London Corn Trade Association Contract or other

customary official contracts. The normal trade channels for marketing wheat in this country will be regularly employed, and the wheat will not be sold at an artificial price. A Committee representative of the agent firms has been set up in London for consultation day by day regarding the sale of the wheat.

Any profit, after payment of all charges, arising out of the difference between the sale of the wheat at its natural price in London and its purchase at the officially regulated price in India, will form part of the revenues of the Government of India. Information as to the method by which funds will be supplied to the firms employed as buying agents in India will be the subject of a subsequent announcement.

Notice to Farmers as to Maximum Production of Crops and Stock, and Especially as Regards Slaughter of Animals.

THE attention of the Board of Agriculture and Fisheries has been drawn to the fact that the prevailing conditions are causing many farmers to experience difficulty in maintaining the normal standard of production of their holdings, especially with regard to live stock. The shortage of labour and the increased cost of feeding stuffs, in conjunction with the high prices at which all classes of stock are selling, are tempting a number of farmers to make an immediate profit at the expense of future output and increased returns. Many breeders are marketing their stock before it has arrived at maturity, and several dairy farmers are either reducing or disposing of their herds to an extent that is very much to be regretted.

The slaughter of female animals suitable for breeding is particularly undesirable. The Board possess strong evidence that there is a tendency to fatten an unusual number of heifers, ewes, and sows, and to send in-calf cows and in-pig sows to the butcher. This practice, if it should become general, would lead to a serious reduction in the number of flocks and herds in the country.

The shortage of milkers appears to have tended to the dispersion of dairy herds, in part for slaughter, but it might be remembered that the calf is nature's milker, and where no other means are available it may prove a profitable venture to adopt the practice, still common in many pedigree and beef herds, of rearing two or three calves on the same cow, more especially having regard to the high price which store stock is likely to command for some time to come. The Board trust, however, that the production of milk for market will remain the primary consideration, and with that object in view the employment of women milkers might be greatly extended.

The cost of pig feeding may be reduced if store pigs and sows are allowed to run out on grass or on green crops, such as rape, when they will pick up the greater portion of their living. This will not only effect a saving of meal and offals but will also be healthy for the pigs. For fattening pigs, green crops may be fed in conjunction with meal and offals and result in a material saving of purchased food.

By the adoption of expedients of this kind the usual head of stock may be maintained at the minimum cost.

Although an avoidable slaughter of calves is taking place, there is no reason to suppose that it is on a larger scale than usual, and there is evidence to show that in some districts an increased number of calves

is being reared by farmers who are wise enough to look ahead and consider the future situation. In doing so they are taking the right and patriotic course, and one which there is every reason to expect will prove profitable to them.

The Board desire to emphasise the importance of maintaining the flocks and herds of the country at their maximum, and of marketing them only when at their highest economic value. Of the total quantity of meat consumed in this country about three-fifths are usually produced in the United Kingdom, and the withdrawal from the quantity normally imported of the supply required for the Armies must render the civilian population more than ever dependent upon home supplies.

Another matter that has been brought to the notice of the Board is the intention expressed by some farmers to reduce the area of grassland to be mown for hay. Any action of the kind would be most regrettable under present circumstances, when not only have the needs of the farm to be considered, but also the supplies for the Army, which must be maintained at all costs. The Board would therefore impress on farmers the desirability of arranging to retain at least as large an acreage as usual for hay.

The Board feel confident that the agricultural community will do everything in its power to ensure the maximum production of the crops and stock needed for present and future requirements, and although the result may have to be achieved in the face of some difficulties, the Board believe that these difficulties are not insurmountable and that they can rely on farmers to place the interests of the State before all other considerations.

Hay for His Majesty's Forces.

THE attention of the Board of Agriculture and Fisheries has been drawn to the rumours which are being circulated amongst farmers to the effect that the War Office intend to commandeer the stocks of hay in the country at whatever price they may deem reasonable. The Board have reason to suppose that these rumours are giving rise to a feeling of uneasiness in country districts, and, therefore, they think it desirable to publish the actual position of affairs.

It must be remembered, when considering the situation, that the country is at war, and that it is the duty of all good citizens actively to co-operate with the Military Authorities for the purpose of ensuring that supplies required by His Majesty's Forces are punctually delivered.

The hay required for the Army may be divided into two classes—

1. For overseas shipment.
2. For home consumption.

The hay required for shipment must be steam baled and must consist only of good hard hay, such as some clovers, sainfoin or sainfoin mixture, seed mixture, lucerne and upland meadow hay. Landowners and farmers should use every endeavour to render hay of this description available for military purposes. Hay required for the Home Forces may be of a somewhat lower standard, provided that it is clean, sweet and dry.

The average annual production of hay in the United Kingdom for the 10 years 1904 to 1913 was about 14,148,000 tons. The crop in 1914 was much below the average both as regards seeds and meadow

hay, and is estimated to have been not more than 12,400,000 tons. Fortunately, however, the crop of 1913 was an exceptionally heavy one estimated at 15,400,000 tons, and the surplus of the latter when added to the 1914 crop brings up the stocks of hay in 1914 to about the average.

The quantity of hay required by the Military Authorities amounts approximately to one-fourteenth of the average annual supply. It is evident, therefore, that if the average of production is maintained, the requirements of the Army can be met without any serious interference with the needs of farmers or of trade and private horse and stock keepers.

It has been decided by the War Office—in order to equalise purchases, and to prevent hay from being acquired in districts where there may be a comparative shortage whilst there is a surplus in others—to make use of the powers vested in the Board of Trade under the Articles of Commerce (Returns, &c.) Act, 1914, and to require a return to be made of the stocks of hay in the country. The Board feel sure that farmers will recognise the wisdom of this action and will give it their cordial support.

The War Office hope to obtain all the hay they require by friendly arrangement, but instances may arise in which individuals unreasonably withhold hay required for the use of His Majesty's Forces. In any such cases the War Office have decided to use their powers of requisitioning hay under the Army (Supply of Food, Forage and Stores) Act 1914. It is not, and has not been, their intention to use these powers with the idea of acquiring hay at a price below the fair market value, and in arriving at the price to be offered for the hay required due regard will be had to the actual price paid in the immediate neighbourhood for hay of similar class and quality, and to the amount necessary for use on the farm.

The Board would impress on landowners and farmers the very great importance not only of offering their hay to the Military Authorities, but also of maintaining and, wherever possible, increasing the acreage to be cut for hay this year.

MISCELLANEOUS NOTES.

Weed Control in Canada.

THE importance of obtaining seeds and feeding stuffs free from weed seeds is now well recognised in Canada. The Federal Seed Control Act of 1910 specifies the weeds considered as noxious, and decrees the maximum proportion of such weeds that may be tolerated in farm seeds intended for sowing, while an Order in Council, dated May 1st, 1910, provides that bran, middlings and chopped fodder must be free from living seeds of the noxious weeds defined under the Seed Control Act.

Weed Control Acts have been in operation in a number of Canadian provinces for some years, and the experience gained in their working has been found useful in determining the policy most likely to be effective in the future.

The Acts in the different provinces vary considerably in their scope and detail. In Nova Scotia and Quebec, weed legislation is included in the General Statutes, while in Ontario and Manitoba it forms the subject

of Special Acts. Among the more prominent provisions in force in the various provinces the following may be mentioned. Owners or occupiers of land are made responsible for the suppression of the scheduled weeds on their land. In some provinces they are also made responsible for the roadsides adjoining their land, while in others this duty is apportioned to the Highway Authorities. The railway authorities are bound to observe the provisions of the Acts as far as their land is concerned. Failure to comply with the provisions of the Acts renders the owner of the land liable to a fine or to the refund of the cost of any measures which may be taken to ensure that the provisions are properly carried out.

The administration of such legislation is usually vested in the municipal authorities, who appoint inspectors and superintend the general working of the Acts. In Quebec no inspectors are appointed, but any person can, by special notice, require an owner of land to cut down any recognised noxious weed on his land, and, in case of default, proceedings may be taken and the owner fined. In Manitoba the Act goes so far as to provide for the destruction of a growing crop or the condemnation of land as being unfit for crop purposes where the presence of weeds renders such courses desirable. The Act also provides that threshing machines must be properly cleaned before being removed from one farm to another, and prohibits the depositing of weed seeds on any road, and the sale of screenings from mills or granaries in the province. In the North West Territories, also, an inspector has the power to order the cutting down or ploughing under of a corn crop if noxious weeds are present.

Although the legislation has met with some success, it is now freely admitted that, without the support and co-operation of the farmers themselves, legal restrictions are of little avail. Most of the provinces recognise that the primary consideration is to educate the farmer as to the appearance and habits of growth of the worst weeds, together with the methods of exterminating them. Educational work of this nature is now being provided for in several of the provinces.

In this connection it is interesting to note a novel form of education which has been undertaken by the Ontario Agricultural and Experimental Union. Recognising that there are a number of methods of eradicating the different weeds, the Union arranged during 1912 and 1913 with some 26 farmers to carry out a series of experiments in order to indicate the methods best suited to local conditions. In these two years only four weeds, Perennial Sow Thistle, Twitch Grass, Bladder Campion and Wild Mustard were selected, but it was intended to add other weeds to the experimental list in 1914, and it was hoped that the number of experimenters would be increased.

The subjects of the experiments which were carried out were:

1. The use of rape in the destruction of Perennial Sow Thistle.

2. A system of intensive cropping for the eradication of Perennial Sow Thistle.

3. The use of rape in the destruction of Twitch Grass,

4. A method of cultivation and cropping for the extermination of Twitch Grass.

5. A method of cultivation and cropping for the eradication of Bladder Campion.

6. Spraying with iron sulphate to destroy Wild Mustard in cereal crops.

Not only are these experiments valuable in themselves, but they are of great service as a means of educating the farmers and securing their active co-operation in weed destruction. It is hoped that educational work of this nature, if undertaken throughout the country and combined with suitable legislation, will do much to provide a solution to the weed problem. (*Agricultural Gazette of Canada*, 1914.)

Notes on Crop Prospects Abroad.

THE *Bulletin of Agricultural and Commercial Statistics* for April, 1915, contains the following information regarding cereal crops :—

Denmark.—The final figures place the production of wheat in 1914 at 723,000 qr., against 837,000 qr. in 1913, a decrease of 13·5 per cent.; of rye at 1,300,000 qr., against 1,983,000 qr., a decrease of 34·5 per cent.; of barley at 2,729,000 qr., against 3,282,000 qr., a decrease of 16·9 per cent.; and of oats at 4,841,000 qr., against 5,856,000 qr., a decrease of 17·3 per cent.

Argentina.—The preliminary estimate places the production of rye in 1914-15 at 211,000 qr. compared with 390,000 qr. in 1913-14, or a reduction of 45·9 per cent.

India.—The production of wheat in 1914-15 is estimated at 48,020,000 qr., against 39,041,000 qr. in 1913-14, or an increase of 23 per cent., while the area under the crop was greater by 13 per cent.

Condition of Winter Cereals.—The condition of the crops on the 1st April was as follows (100 being taken to represent the prospect of an average crop) :—

Wheat.—Denmark 101, Scotland and Ireland 100, Switzerland 99, Lower Egypt 107, Upper Egypt 102.

Rye.—Denmark 104, Switzerland 98. *Barley*.—Switzerland 101, Lower Egypt 99, Upper Egypt 104.

Canada.—Reports received by the Minister of Agriculture from Manitoba, Saskatchewan and Alberta, state that practically all the wheat has now been sown, which is earlier than usual, and that all through the Southern sections, where drought obtained last year, the moisture now in the soil is the heaviest on record.—*Reuter*. (*London Grain, Seed and Oil Reporter*, 29th April).

United States.—The Statistician of the Department of Agriculture, in reporting as to crop conditions on the 1st May, states that the area under winter wheat at that date was 40,169,000 acres, 1,094,000 acres of the total area sown having been abandoned, whilst the area at the same time last year was 36,008,000 acres. The average condition of the crop is estimated at 92·9 per cent., which compares with 88·8 per cent. in April, and 95·9 per cent. a year ago, and the total production is estimated at 693,000,000 bushels as compared with the final estimate of 684,000,000 bushels last year. The condition of winter rye is estimated at 89·8 per cent. against 89·5 per cent. in April, and 93·4 per cent. a year ago. (*Broomhall's Corn Trade News*, 7th May.)

Argentina.—The maize crop of 1914-15 is officially estimated at 8,590,000 tons, as compared with a yield of 6,880,000 tons in the previous year. The area under the crop is 10,380,000 acres. (*London Grain, Seed and Oil Reporter*, 14th April).

The *Review of the River Plate* of 9th April says that after three weeks of comparatively dry weather throughout the cereal zone, very heavy rains fell during the last three days of the previous week. The fall was

exceptionally heavy in some parts of Santa Fé and Cordoba, and caused inundations in the districts of Rufino and Laboulaye through the overflowing of Rivers 4 and 5. The maize crop in the north is giving better results than last year, and from all parts where harvesting is progressing similar reports are to hand.

New Zealand.—According to returns issued by the Government Statistician on the 2nd March, the total estimated yields of the principal crops for the season 1914–15 are as follows:—wheat 615,000 qr. as compared with 654,000 qr. in the previous year, oats 1,274,000 qr. against 1,843,000 qr., and barley 64,000 qr. against 151,000 qr.

Live Stock in Germany.—The preliminary data from the enumeration of 1st December, 1914, place the number of cattle at 21,817,769 against 20,994,344 on the same date in 1913, an increase of 3·9 per cent.; of sheep at 5,448,539 against 5,520,837, a decrease of 1·3 per cent.; and of pigs at 25,339,627 against 25,659,140, a decrease of 1·2 per cent. (*Bulletin of Agricultural and Commercial Statistics*, April, 1915).

Live Stock in Sweden.—The preliminary figures of the number of live stock on the 31st December, 1913, are as follows:—Horses 596,136, against 588,485 on the same date in 1911, or an increase of 1·3 per cent.; cattle 2,720,741, against 2,689,609, an increase of 1·2 per cent.; sheep 988,163, against 945,709, an increase of 4·5 per cent.; pigs 967,684, against 951,164, an increase of 1·7 per cent. (*Bulletin of Agricultural and Commercial Statistics*, April, 1915).

Agricultural Labour in England and Wales during April.

According to statements in the Board's *Monthly Agricultural Report* for 1st May, the supply of labour was everywhere scarce during April, but the apprehensions expressed before the heavy spring work commenced were not realised to so great an extent as was feared, partly owing to the fine weather having enabled continuous progress to be made; while in some cases mention was made of the assistance given by women. In a few districts the scarcity was serious enough to interfere with field work.

The following local summaries give further details regarding agricultural labour in the different districts of England and Wales:—

Northumberland, Durham, Cumberland, and Westmorland.—There was a deficiency in the supply of labour in practically every district, but farmers were getting the more important work done. The deficiency appears to be most felt in the north and south-east of Durham and in south Westmorland.

Lancashire and Cheshire.—Though not seriously hampering farm work, labour was deficient throughout the division except in north-east Lancashire, where there appeared to be a sufficiency.

Yorkshire.—The supply of labour was deficient throughout the division, more particularly as regards horsemen and casual labour for potato planting.

Shropshire and Stafford.—The supply of labour was very deficient, and farmers were finding it difficult to keep the work up to date. Casual labour was difficult to obtain, in spite of increased wages.

Derby, Nottingham, Leicester and Rutland.—The supply of labour was very deficient; in some districts wages again advanced, others reported no change. In parts of Nottingham mention was made of the employment of women.

Lincoln and Norfolk.—The supply of labour was generally deficient and wages were still rising in some parts. Casual labour for potato planting was very scarce, but women were employed fairly extensively.

Suffolk, Cambridge, and Huntingdon.—Labour was short; but farmers were adapting themselves to the new conditions, and the supply was just sufficient for present needs. Several increases of 1s. per week in wages were reported from Suffolk.

Bedford, Northampton, and Warwick.—There was still a general shortage of labour, but in parts of Bedfordshire and Northamptonshire the scarcity was less marked than in most districts.

Buckingham, Oxford, and Berkshire.—The supply of labour, particularly of casual hands, was deficient, although, on the whole, it did not seem to be so short as expected, and the improved weather enabled work to proceed almost normally.

Worcester, Hereford, and Gloucester.—Labour was deficient throughout the division, except in eastern Herefordshire, where the supply was stated to be somewhat better.

Cornwall, Devon, and Somerset.—The shortage of labour continued, but, owing to the dry weather, was not felt so keenly, particularly in Devon and Cornwall. In Somerset, however, the deficiency was very marked.

Dorset, Wiltshire, and Hampshire.—Labour was everywhere deficient, but most of the important work was being satisfactorily carried out.

Surrey, Kent, and Sussex.—The supply of labour seemed more adequate in Kent than in most parts, and the work on farms was well forward. Complaints of a shortage were general in Surrey, and some parts of Sussex reported a considerable deficiency.

Essex, Hertford, and Middlesex.—In the west of Essex there was a satisfactory supply of women for potato planting, and in the north-west of Essex there was a fair supply of labour except horsemen, but in other districts the supply was deficient.

North Wales.—Labour was very scarce in most places, but in one or two districts in Anglesey, Carnarvon and Merioneth the shortage was not marked.

Mid Wales.—In the south-west of Cardiganshire the supply of labour was sufficient, and in Brecon the shortage was not felt much up to the present, but in other parts of the division there was a decided scarcity of both skilled and casual labour.

South Wales.—There was considerable deficiency in all four counties, both of temporary and permanent labour.

Agricultural Conditions in England and Wales on 1st May.

THE Crop Reporters of the Board, in commenting on agricultural conditions in England and Wales on the 1st May, report that the young corn crops generally look well. The weather was nearly everywhere dry throughout most of the month, but wheat has, upon the whole, rather improved. Good progress was made with the sowing of the spring corn, except on some heavy lands which were too dry to work, and the young plants are satisfactory. Warm rains are now wanted to bring them on.

Potato planting is well advanced in all the more important districts; in some places it is reported that the work has been hindered by the want of sufficient labour. On the whole, this work is probably little more backward than usual. Variable progress has been made with mangold sowing; the seed is going in under favourable conditions, and the progress made is, in most places, about normal for the time of year.

Seeds have everywhere made but little growth, owing to the cool, dry weather, and frosts at night have frequently checked them. They are backward but healthy, and in the west and north are a st ong plant. Pastures have been similarly kept back, and are very bare for the time of year. Rain is much wanted for all grassland. Live stock have hardly made much progress during the month, although they are generally healthy, but somewhat backward in condition, the want of green food being felt. In most cases they have been turned out later than usual.

Root crops grown for seed in the eastern counties are generally unpromising, owing, it is stated, to the summer last year having been too dry.

Fruit trees are backward, but there is plenty of blossom, particularly on stone-fruit. Some apprehension is expressed that the night frosts towards the end of April may have caused damage, but hardly any is actually reported.

The lambing season has hardly been a good one upon the whole, and the mortality, both among ewes and lambs, seems to have been at least equal to the average. The reports from the later flocks in the north are scarcely up to those in the south, but in Wales they are more satisfactory.

Prevalence of Animal Diseases on the Continent.

THE following statement shows that according to the information in the possession of the Board on 1st May, 1915, certain diseases of animals existed in the countries specified :—

Denmark (month of February).
Anthrax, Foot-and-Mouth Disease (181 outbreaks), Glanders and Farcy, Swine Erysipelas, Swine Fever.

France (for the period 4th—17th April).
Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox.

Holland (month of March).
Anthrax, Foot-and-Mouth Disease (45 outbreaks), Foot-rot, Glanders, Swine Erysipelas.

Italy (for the period 12th—18th April).
Anthrax, Blackleg, Foot-and-Mouth Disease (112 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever, Tuberculosis.

Norway (month of March).
Anthrax, Blackleg, Swine Fever.

Rumania (for the period 21st—29th March).
Anthrax, Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Fever.

Russia (month of December).
Anthrax, Foot-and-Mouth Disease (43,787 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (month of February).
Anthrax, Blackleg, Dourine, Glanders, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of March).
Anthrax, Blackleg, Foot-and-Mouth Disease (8 outbreaks), Swine Fever.

Switzerland (for the period March 15th—21st).

Anthrax, Blackleg, Foot-and-Mouth Disease (83 "étables" entailing 1,192 animals, of which 11 "étables" were declared infected during the period), Sheep-scab, Swine Fever.

No further returns have been received in respect of the following countries:—Austria, Belgium, Bulgaria, Germany, Hungary, Montenegro, Servia.

The Weather in England during April.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
Week ending Apr. 3rd:								
England, N.E. ...	37·0	2·8	0·28	7	— 3	3	4·6	—0·1
England, E.	31·1	—3·7	0·20	5	— 4	3	5·9	+1·2
Midland Counties ...	38·4	—4·3	0·24	6	— 4	2	4 4	+0·1
England, S.E.... ...	38·9	—5·1	0·22	6	— 3	2	5·2	+0·4
England, N.W. ...	39·8	—2·8	0·73	18	+ 4	2	5·1	+1·0
England, S.W. ...	38·9	—5·3	0·36	9	— 6	2	5·4	+0·7
English Channel ...	42·2	—4·4	0·16	4	— 8	2	5·3	—0·3
Week ending Apr. 10th:								
England, N.E.... ...	43·9	+1·4	0·09	2	— 8	2	7·3	+2·2
England, E.	45·4	+1·6	0·28	7	— 2	3	6·0	+0·9
Midland Counties ...	44·4	+0·6	0·32	8	— 2	4	6·0	+1·3
England, S.E.... ...	45·9	+0·7	0·63	16	+ 8	4	5·7	+0·7
England, N.W. ...	43·6	—0·1	0·69	18	+ 5	5	6·0	+1·9
England, S.W. ...	45·7	+0·4	0·76	19	+ 5	6	4·4	—0·7
English Channel ...	47·0	—0·6	1·25	32	+21	7	3·8	—2·2
Week ending Apr. 17th:								
England, N.E. ...	45·5	+2·1	0·22	6	— 3	2	4·5	—0·5
England, E.	44·3	—0·3	0·37	10	+ 1	2	4·5	—0·0
Midland Counties ...	45·5	+0·9	0·22	6	— 4	2	4·0	—0·7
England, S.E.... ...	45·6	—0·4	0·34	9	+ 1	2	4·8	—0·4
England, N.W. ...	45·6	+1·0	0·22	5	— 7	4	4·1	—0·0
England S.W. ...	46·8	+0·8	0·12	3	—10	2	3·9	—1·5
English Channel ...	48·1	—0·1	0·16	4	— 7	2	6·5	+0·3
Week ending Apr. 24th:								
England, N.E. ..	44·5	0·0	0·12	3	— 6	2	4·6	—0·4
England, E.	44·7	—2·5	0·05	1	— 8	1	6·9	+1·7
Midland Counties ..	44·4	—1·4	0·14	3	— 7	3	3·4	—1·4
England, S.E.	44·8	—2·2	0·13	4	— 6	2	6·6	+1·3
England, N.W. ...	44·8	—1·0	0·47	12	+ 1	4	4·9	—0·2
England, S.W. ...	45·3	—1·6	0·20	5	— 9	3	4·4	—1·1
English Channel ...	47·4	—1·5	0·21	5	— 7	3	7·2	+0·8
Week ending May 1st:								
England, N.E. ..	47·8	+1·9	0·36	9	0	3	7·6	+2·3
England, E.	49·3	+2·1	0·14	4	— 6	2	6·9	+1·3
Midland Counties ...	50·0	+2·7	0·27	7	— 4	2	7·6	+2·5
England, S.E.... ...	50·1	+1·7	0·06	2	—10	1	7·2	+1·5
England, N.W. ...	49·1	+2·0	0·50	13	0	2	8·0	+2·9
England, S.W. ...	50·6	+2·5	0·17	4	—12	2	7·3	+1·6
English Channel ...	50·1	+0·2	0·29	5	— 8	2	7·0	—0·3

* 1 inch = 25·4 millimetres.

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	APRIL.		FOUR MONTHS ENDED APRIL.	
	1915.	1914.	1915.	1914.
Anthrax:—				
Outbreaks	59	72	267	315
Animals attacked	69	76	297	337
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	11
Animals attacked	—	—	—	74
Glanders (including Farcy):—				
Outbreaks	4	7	11	33
Animals attacked	5	9	16	79
Parasitic Mange:—				
Outbreaks	189	151	*189	1,076
Animals attacked	439	226	*439	1,990
Sheep-Scab:—				
Outbreaks	9	5	143	139
Swine Fever:—				
Outbreaks	327	384	1,275	1,165
Swine Slaughtered as diseased or exposed to infection ...	1,573	4,089	5,546	11,367

* Figures for one month only, the Parasitic Mange Order of 1911 having been suspended from 6th August, 1914, to 27th March, 1915, inclusive.

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	APRIL.		FOUR MONTHS ENDED APRIL.	
	1915.	1914.	1915.	1914.
Anthrax:—				
Outbreaks	—	—	1	—
Animals attacked	—	—	1	—
Foot-and-Mouth Disease:—				
Outbreaks	—	14	—	60
Animals attacked	—	116	—	827
Glanders (including Farcy):—				
Outbreaks	1	—	1	—
Animals attacked	3	—	3	—
Parasitic Mange:—				
Outbreaks	3	10	16	30
Sheep-Scab:—				
Outbreaks	38	23	213	311
Swine Fever:—				
Outbreaks	30	27	95	88
Swine Slaughtered as diseased or exposed to infection ...	159	78	567	395

Unit Prices of Artificial Manures.

Statement of cost to the purchaser of 1 per cent. per ton of Nitrogen, Soluble and Insoluble Phosphates, and Potash derived from

	London.	King's Lynn.	Hull.	Newcastle.
	s. d.	*s. d.*	*s. d.*	*s. d.*
Nitrogen from:				
Sulphate of Ammonia pure ... { 95%	14 9	14 0	14 6	14 0
{ 93%	—	14 8	13 9½	13 2
Calcium Cyanamide ...	—	—	12 7	12 3
Nitrate of Soda pure ... ... { 95%	—	—	17 5	—
{ 90%	17 5	18 0	17 0	18 0
Nitrate of Lime ...	—	—	—	16 5½
Soluble Phosphates from:				
Superphosphate 35%	2 4	2 0	2 4	2 2½
,, 33⅓%	2 4½	—	2 4½	2 2½
,, 30%	2 5½	2 1½	2 6	2 3½
,, 26⅔%	2 8½	2 3½	2 8½	2 6
Dissolved Bones	3 7½	3 1½	3 3	3 3
Allowed for Nitrogen	*20 0*	*17 3½*	*17 10½*	*17 11*
Allowed for Insol. Phos.	*1 11*	*1 8*	*1 8½*	*1 8½*
Insoluble Phosphates (Citric Soluble) from:				
Basic Slag	1 11	1 11	1 10½	—
Insoluble Phosphates from:				
Basic Slag	—	1 7½	1 3½	1 3½
Bone Meal	1 7½	1 7	1 5½	1 5½
Allowed for Nitrogen	*16 11½*	*16 7*	*15 2*	*15 6*
Steamed Bone Flour ...	1 6½	1 3	1 7	1 6
Allowed for Nitrogen	*15 10½*	*13 2*	*16 3*	*15 7*
Potash from:				
Kainit	—	—	—	
Sulphate of Potash ...	—	—	—	
Muriate of Potash ...	—	—	—	—
Potash Salts	—	—	—	—

NOTE.—These unit prices are based on the *probable* retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified, but it should be borne in mind that market prices are fluctuating considerably at the present time. The prices are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the

various sources, at certain ports and Manufacturing Centres, for May, 1915.

Silloth.	Liverpool.	Widnes.	Newport.	Bristol.	Plymouth.
s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
14 0	—	14 3	14 0	—	—
—	14 3	14 5	—	13 10	15 2½
—	—	—	—	—	12 4½
—	16 2½	16 3½	—	—	17 5
17 4	16 4	—	17 6	18 0	—
—	—	—	—	—	—
2 2½	2 2	2 1	2 5½	2 5½	2 5½
2 3½	2 2	2 1	2 6½	2 6½	2 6½
2 3½	2 2½	2 1½	2 7½	2 7½	2 7½
2 6	2 5	2 3½	2 10½	2 10½	2 10½
3 4	3 5½	3 5½	3 9½	3 10	3 10½
18 5	19 2	19 0	20 10½	21 3	21 5½
1 9½	1 10	1 10	2 0	2 0½	2 0½
—	—	—	—	1 11	—
—	1 3½	—	—	—	—
1 8	1 6½	1 6½	1 5	—	1 8½
17 5	16 2	16 3½	14 8½	—	17 8½
1 7	—	—	1 3½	—	1 10½
16 3½	—	—	13 5	—	19 7
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—

manure are multiplied by the percentages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purcha er. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating and rebagging the ingredients, bags, and loss of weight.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in April and March, 1915.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	April. First Quality.	April. Second Quality.	March. First Quality.	March. Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	11 3	10 6	10 11	10 5
Herefords	11 3	10 2	10 10	9 10
Shorthorns	11 2	10 4	10 9	9 11
Devons	11 4	10 6	11 0	10 0
Welsh Runts	10 11	10 2	10 7	9 7
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	10¾	9¾	11	9¾
Sheep :—				
Downs	11¾	10¾	11⅛	10⅛
Longwools	10¾	9⅝	11	9¾
Cheviots	12½	11¼	12⅛	11¼
Blackfaced	12	11½	11⅝	10½
Welsh	12	11	11	10¼
Cross-breds	12	10⅝	11½	10⅛
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	9 5	8 11	9 0	8 6
Porkers	9 10	9 3	9 4	8 10
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	24 5	20 1	24 0	20 2
,, —Calvers ...	23 3	19 1	22 11	18 16
Other Breeds—In Milk ...	22 3	18 4	21 12	18 5
,, —Calvers ...	19 9	16 12	18 4	16 10
Calves for Rearing	2 16	2 3	2 13	2 2
Store Cattle :—				
Shorthorns—Yearlings ...	13 2	11 2	12 13	10 14
,, —Two-year-olds...	17 7	15 4	16 14	14 17
,, —Three-year-olds	22 0	18 15	20 7	18 1
Herefords —Two-year-olds...	19 15	18 1	19 8	17 11
Devons— ,,	18 14	17 2	17 9	15 16
Welsh Runts— ,,	17 3	16 5	16 15	15 9
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	58 2	50 9	54 11	47 1
Store Pigs :—				
8 to 12 weeks old	24 1	18 6	21 7	16 0
12 to 16 weeks old	39 8	30 6	37 10	27 10

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND in April, 1915.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.	Leeds.	Liverpool.	London.	Manchester.
		per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
BEEF:—		s. d.	s. d.	s. d.	s. d.	s. d.
English	1st	76 6	74 0	—	77 6	76 6
	2nd	71 6	71 0	—	74 0	71 6
Cow and Bull	1st	68 6	67 6	67 6	67 6	70 6
	2nd	62 0	60 6	61 0	63 0	64 6
Irish: Port Killed	1st	74 6	—	76 0	75 0	74 0
	2nd	—	—	70 0	72 0	70 0
Argentine Frozen—						
Hind Quarters	1st	64 0	62 6	63 0	61 0	63 0
Fore ,, ...	1st	60 6	60 6	59 6	57 6	59 6
Argentine Chilled—						
Hind Quarters	1st	70 6	70 6	70 6	71 6	70 6
Fore ,, ...	1st	60 6	61 0	61 0	62 0	61 0
Australian Frozen—						
Hind Quarters	1st	62 0	62 6	60 6	61 0	60 6
Fore ,, ...	1st	58 6	59 6	58 6	58 6	58 6
VEAL:—						
British	1st	83 6	90 6	95 0	87 6	89 0
	2nd	74 6	83 0	87 6	78 0	84 6
Foreign...	1st	—	—	—	88 6	—
MUTTON:—						
Scotch	1st	94 6	—	104 0	96 0	102 6
	2nd	91 0	—	93 6	90 6	98 0
English	1st	89 0	92 0	—	91 0	98 0
	2nd	82 0	88 6	—	86 6	92 0
Irish: Port Killed	1st	—	—	91 0	—	93 6
	2nd	—	—	84 0	—	88 6
Argentine Frozen	1st	55 0	55 6	53 6	55 0	53 6
Australian ,, ...	1st	52 0	52 6	50 6	53 6	50 6
New Zealand ,, ...	1st	55 6	58 6	—	59 0	—
LAMB:—						
British	1st	115 6	112 0	118 0	109 6	119 0
	2nd	106 0	107 6	110 6	100 6	109 6
New Zealand	1st	74 6	77 6	77 0	77 6	77 0
Australian	1st	68 0	67 6	67 6	69 6	67 6
Argentine	1st	68 0	67 6	67 6	69 6	67 6
PORK:—						
British	1st	83 0	76 6	78 6	87 0	77 6
	2nd	77 6	74 0	69 6	81 0	71 6
Foreign...	1st	—	—	—	--	—

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in April, 1915.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER:—	per 12 lb	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	16 6	15 6	—	—	15 6	14 0
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	—	—	137 6	135 6	—	—
„ Factory	—	—	128 0	124 0	—	—
Danish...	—	—	144 6	141 6	143 0	139 0
French...	—	—	—	—	140 0	136 0
Russian	—	—	—	—	132 0	128 0
Australian	137 6	133 6	137 0	134 6	136 0	132 0
New Zealand	140 6	138 6	140 0	137 6	140 0	136 0
Argentine	136 6	134 6	134 0	131 6	133 0	130 0
CHEESE :—						
British—						
Cheddar	102 0	99 0	103 6	101 0	104 6	99 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	93 6*	88 6*	107 0	102 0
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	98 0	96 6	96 0	95 0	98 0	94 0
BACON:—						
Irish (Green)	91 6	87 6	90 0	87 6	90 0	86 0
Canadian (Green sides)	77 6	73 6	77 0	71 0	78 0	73 6
HAMS:—						
York (Dried or Smoked)	116 0	114 0	—	—	116 0	110 0
Irish (Dried or Smoked)	—	—	—	—	107 0	100 0
American (Green) (long cut)	66 0	62 0	64 6	61 0	67 0	62 0
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120	per 120
British...	10 2	9 4	—	—	11 8	10 10
Irish	10 7	10 1	10 5	9 10	11 7	11 1
Danish...	—		—	—	12 9	11 7
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Edward VII.	109 0	95 0	86 6	—	101 6	91 0
Langworthy	100 0	90 0	100 0	95 0	106 0	100 0
Up-to-Date	102 6	87 6	81 6	78 6	106 0	94 0
HAY:—						
Clover...	—	—	123 6	98 6	106 6	97 0
Meadow	—	—	—	—	97 6	88 0

* New.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1913, 1914 and 1915.

Weeks ended (*in* 1915).	WHEAT.			BARLEY.			OATS.		
	1913.	1914.	1915.	1913.	1914.	1915	1913	1914.	1915.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Jan. 2 ...	30 5	31 1	44 4	28 6	26 2	29 10	19 10	18 2	26 6
,, 9 ...	30 3	30 11	46 2	28 4	25 11	29 7	19 2	18 4	26 5
,, 16 ...	30 5	31 0	48 9	28 6	26 0	30 5	19 4	18 6	27 6
,, 23 ...	30 11	30 11	51 6	28 10	26 3	31 3	19 4	18 11	28 10
,, 30 ...	31 1	31 1	52 8	28 11	26 6	32 5	20 2	19 1	29 10
Feb. 6 ...	31 0	31 0	53 3	28 10	26 7	33 7	20 1	18 9	30 3
,, 13 ...	30 9	31 0	54 8	29 1	26 7	34 7	20 2	18 11	31 1
,, 20 ...	30 11	31 0	56 0	28 8	26 7	34 11	20 7	18 11	31 5
,, 27 ...	31 0	31 0	56 0	28 6	26 6	35 3	20 4	18 11	31 8
Mar. 6 ...	31 3	31 5	55 11	28 5	26 2	34 6	20 0	18 9	31 8
,, 13 ...	31 1	31 6	54 8	27 11	26 0	33 5	20 2	18 7	31 0
,, 20 ...	31 1	31 5	53 9	28 6	25 8	32 2	19 11	18 6	30 7
,, 27 ...	31 3	31 4	54 3	27 6	25 7	31 11	19 7	18 8	30 6
Apl. 3 ...	31 4	31 6	54 6	27 0	25 6	31 9	19 2	18 5	30 6
,, 10 ...	31 3	31 5	54 9	27 8	26 8	31 3	19 2	18 4	30 4
,, 17 ...	31 6	31 7	55 4	26 11	25 4	30 10	18 10	18 4	30 5
,, 24 ...	31 8	31 9	56 5	26 7	26 6	31 5	19 3	18 5	30 11
May 1 ...	32 2	31 9	58 3	25 11	26 0	32 7	19 6	18 5	31 5
,, 8 ...	32 6	32 2		25 9	25 6		19 6	18 9	
,, 15 ...	32 10	32 7		25 4	26 3		19 9	18 11	
,, 22 ...	32 10	33 0		25 3	25 10		19 11	19 0	
,, 29 ...	32 7	33 9		26 1	26 1		20 1	19 4	
June 5 ...	32 10	34 0		26 2	25 11		19 8	19 4	
,, 12 ...	32 8	34 1		24 7	24 11		20 2	19 8	
,, 19 ...	32 8	34 1		23 10	25 10		19 8	19 9	
,, 26 ...	32 8	34 3		24 3	25 4		19 1	20 0	
July 3 ...	33 1	34 4		25 2	24 6		21 0	19 9	
,, 10 ...	33 4	34 2		25 10	24 9		19 4	20 0	
,, 17 ...	33 6	34 1		24 9	24 2		20 5	19 10	
,, 24 ...	33 10	34 0		24 1	24 7		20 8	19 9	
,, 31 ...	34 1	34 2		24 5	25 9		20 3	19 8	
Aug. 7 ...	34 1	34 9		24 9	25 2		19 0	19 1	
,, 14 ...	34 3	40 3		24 7	29 4		18 7	25 1	
,, 21 ...	33 7	38 9		26 5	29 10		18 8	24 3	
,, 28 ...	32 7	36 2		29 0	30 3		17 10	23 5	
Sept. 4 ...	31 11	36 5		30 11	30 6		17 8	23 9	
,, 11 ...	31 9	37 10		31 5	29 11		18 0	23 11	
,, 18 ...	31 7	38 3		30 9	29 5		17 11	23 8	
,, 25 ...	31 6	37 6		30 1	29 3		17 9	23 3	
Oct. 2 ...	31 3	37 1		29 9	29 1		17 10	22 9	
,, 9 ...	31 0	36 8		29 1	28 10		17 10	22 5	
,, 16 ...	30 11	36 7		28 8	28 8		17 9	22 4	
,, 23 ...	30 7	37 2		28 7	28 7		18 0	22 5	
,, 30 ...	30 1	37 10		28 2	28 3		17 9	23 7	
Nov. 6 ...	30 0	38 8		28 1	28 6		17 9	23 7	
,, 13 ...	30 1	39 8		27 8	29 0		17 11	24 8	
,, 20 ...	30 4	41 0		27 5	29 8		18 1	25 5	
,, 27 ...	30 9	41 11		27 0	30 3		18 4	25 8	
Dec. 4 ...	31 2	42 2		26 8	30 2		18 4	25 9	
,, 11 ...	31 2	42 1		26 5	29 11		18 6	25 9	
,, 18 ...	31 2	42 7		25 11	29 8		18 5	25 9	
,, 25 ...	31 0	43 3		25 10	29 9		18 4	25 11	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of April, 1914 and 1915.

	WHEAT.		BARLEY.		OATS.	
	1914.	1915.	1914.	1915.	1914.	1915.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London	32 5	56 11	25 4	32 9	19 10	32 2
Norwich	31 3	54 7	25 2	30 5	17 10	30 6
Peterborough	31 0	55 8	26 0	30 3	18 6	30 11
Lincoln	31 11	56 5	25 9	30 10	18 10	30 8
Doncaster	31 5	54 11	25 5	30 0	18 5	29 3
Salisbury	30 6	53 8	23 10	31 11	17 11	31 7

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